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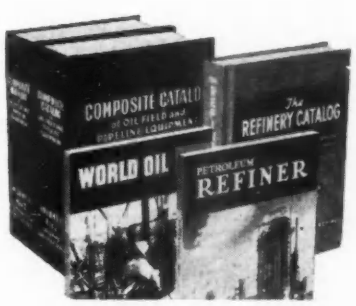

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A Quick Guide to

WORLD OIL this month . . . .

Current Outlook

The West Coast is becoming a broader market. Oil is rising from a self-sufficient industry in the area to take its place in the national and international picture. What has caused this sudden change? Where is the oil to supplement California's production coming from? What does the future hold for the West Coast oil industry? See **Page 68.**

Can the Spraberry hoard be recovered? You can get answers on both sides of this question. Charles J. Deegan, a petroleum consultant, sees no cause for alarm or dismay but recommends some constructive worrying. He explains the problem and how the new methods promise a higher percentage of recovery. **Page 73.**

Seriously damaging to U. S. foreign relations is the government's suit against oil companies on world oil cartel charges. Largely political and not constructive, it will be twisted into anti-capitalist propaganda by the forces of Communism. Filed just before the presidential election, the case is reminiscent of the "Mother Hubbard" anti-trust case, filed as Franklin D. Roosevelt sought a third term against precedent. American oil companies, encouraged on the basis of national interest in their foreign ventures by the State Department, now are being censured for the same actions by the Federal Trade Commission and the Department of Justice. This inconsistency of their own government certainly is no help to U. S. oil companies in their difficult, hazardous work in making oils readily and cheaply available to the people of the world. **Page 78.**

Can the oil industry reduce its accident rates in the same proportion that other industries have? After World War II it did a good job until 1951. This attests to the strong need for continuation and expansion of company safety programs. Every oil company employe has a stake in this and should find interesting the article starting on **Page 85.**

An oversupply of oil threatens the industry's economic outlook. Too much crude is being produced. Excessive crude stocks will result unless allowables are reduced below November record levels. Adequate refined product supplies also exist, with distillate fuel inventories at all-time peak. The outlook is for lower refinery runs, which further aggravates the situation by lessening the need for crude. Careful adjustment of producing and refining operations to needs is required to prevent conditions from getting completely out of hand. **Page 58.**

Exploration

More oil will be found in North Louisiana and South Arkansas if there is a clearer understanding of the geologic events that affected the area. To further this understanding, a well known stratigrapher and paleontologist describes the events that have transpired in geologic time throughout the Lower and Upper periods of the Mesozoic era in the region. *Louisiana and Arkansas Region May Yield Additional Oil.* **Page 108.**

Is Southeastern Colorado a new "hot spot?" Recent discoveries in Pennsylvanian rocks of Western Kansas have put the exploration spotlight on this area. To bring it into clearer focus, here's an article on the geology of the region that not only will help geologists but also operators and drillers working the area. Maps and cross sections accompany the article. **Page 101.**

Drilling

Retrieving junk by a magnetic fishing tool offers an improved fishing technique which will be welcomed by drilling personnel. Capable of lifting 750 pounds or more, it may help reduce expensive downtime. Described in an article on **Page 135.**

Greater productivity from gas-drilled wells, producing under practically identical conditions as conventionally drilled wells, is shown in a 14-year case history. A production decline curve reflects that drilling-in with gas offers beneficial increases in well life and productivity. New techniques of using dual drill pipe to improve air- or gas-drilling are offered to the reader as an example of a recent California development applicable to other regions, in the article *Gas-Drilled Wells Yield More Oil.* **Page 139.**

Use this condensed information on this month's principal articles. Run through these digests . . . . rapidly. ✓ Check those you want to read first.

Avoid that hernia! Learn to lift! Handling of objects causes 22 percent of all industrial injuries. These accidents, bad for morale and extremely costly, are caused by lifting the wrong way, lack of coordination between workmen, overtaxing of physically fit workers and poor housekeeping. For a pictorial lesson on how to lift, turn to **Page 146.**

✓

Offshore problems are being solved in Oklahoma. It's a long way from Lake Maracaibo in Venezuela to Lake Texoma, but the problems are similar. Caving conditions . . . dipping formations . . . crooked holes. These are a few of the many obstacles being mastered. Hubert E. Bale, geologist, engineer and producer, tells about them on **Page 148.**

✓

Drilling contractors—you will lose money unless your cost accounting system has been modernized since World War II. F. H. Rousey, a C.P.A., tells you about the factors which should be included in up-to-date accounting for contractors in article on **Page 153.**

✓

Latest improvement in power rig design is the application of torque converters to drilling equipment. For a simple, yet detailed, explanation of the performance characteristic of torque converters, turn to **Page 154.**

✓

New offshore drilling and producing techniques are awaiting the resumption of tidelands activity. While the tidelands ownership battle rages in Congress, technicians are busy. Busy developing new and more economical methods of drilling in deep water and gathering oil from submerged wells. Read about these developments and examine the drawings on **Page 166.**

Production

How would you calculate the "best" well spacing pattern in a gas field? Dr. David Cornell of the Texas Petroleum Research Committee, University of Texas, comes out with some very practical suggestions. They are embodied in the article *How to Determine Gas Well Interference Graphically.* It starts on **Page 187.**

✓

How to design corrosion inhibitor injection systems, automatic or semi-automatic is the subject of the article starting on **Page 190.** The author offers three suggestions which might fit your situation. He keeps in mind that cost is important, too.

Secondary recovery with air instead of water is doing a good job in Kansas. The subsurface conditions, the equipment installation necessary and the results are set out in an article on **Page 196.** Here is another instance of where field use confirmed laboratory research findings.

✓

Operate in a sour crude area? How much is hydrogen sulphide corrosion costing you per well on production equipment alone? You'll find the answer—and it is most important—in an article beginning on **Page 200.** It tells how to do something about this loss, too. Here is a problem on which the National Association of Corrosion Engineers has been conducting an extensive study. What these corrosion costs are per well are shown in the report on the study which is published in full. Suggestions for reducing the losses, as printed on **Page 205** will be the subject of a series of articles in the Production Section in forthcoming issues of WORLD OIL. The first of the series, on West Texas, appeared on Page 264 of the October issue.

✓

Electric logs aid water flood evaluations by giving the operator valuable data on which to base a successful secondary recovery program. Here's an article pointing out that—if carefully used—electric logs show continuity of sands, porosity, permeability, oil and connate water saturation. Examples cited are from the Bradford and Allegany fields. It can work in other areas. **Page 206.**

✓

If you could get most of the ideas on treating crude oil emulsions written into one article, you would have exactly the article entitled *Emulsion Treating Costs Can Be Cut.* **Page 212.** The author cites simple and practical ideas, rules and diagrams. No expensive gadgets. This is an article that will be liked by both engineers and non-engineers.

Pipe Line

One of the most incredible pipe line feats of our time. That's the description generally accorded the building of the El Paso Natural Gas Company system. More than 6000 miles of pipe across mountains, wastelands and fertile fields. It's all in *The El Paso Story* on **Page 239.**

✓

They saved a half million dollars. Transcontinental Gas Pipe Line Company pitted sound engineering and construction know-how against the five-knot tide of the Narrows and repaired a 24-inch line in 105 feet

of water. Replacement costs were almost prohibitive. Many engineers said a repair job was impossible. How Transco did it is in an article starting on **Page 248.**

Making up or breaking out 1000 feet per hour of three-inch screw pipe, using a farm tractor with a truck transmission—that's pipelining! All the crew has to do is to stab the joints together and into the machine—but read the article for full know-how. **Page 254.**

A quick easy method of computing efficient tank sizes for various products at a pipe line terminal is offered in an article on **Page 257.** Since tankage is a major cost in constructing a products terminal, pipe lines can effect an old fashioned savings by efficient design—the subject of this article.

Dual lines to speed deep-water tanker turnarounds and save money for Union Oil Company. How? See **Page 260.**

Minimum current needed to overcome a hot spot in cathodic protection of a line, as shown in recent field experiments, is discussed in an article on **Page 262.**

Many defects in gathering system design can be eliminated by using a common sense check list of necessary steps. A check list prepared by an efficient operator will be found starting on **Page 267.**

How pressure surges cut pump efficiency has been determined in highly-controlled experiments using 2½-inch by 3-inch reciprocating pump. These tests are described in an article beginning on **page 264.** An article to interest engineers and executives, here's a summary of the experiments and an explanation of how savings can be made.

An economical way of breaking up electrolytic current flow from christmas tree to pipe lines by means of a new high-pressure union is given on **Page 269.**

More about plastic pipe for gathering systems is told in an article on a recent sizable application in California. Where, how, what—see **Page 270.**

Design of two semi-automatic pump stations, added to a line to step up deliveries economically, is described on **Page 276.** Remote control by teletype helped do the job.

"Mr. Pipeliner Himself," Burt Hull was once dubbed by a former WORLD OIL editor. Eric Schroeder, who has exceptional ability to paint word pictures of interesting people, tells about Burt Hull in a sketch done especially for WORLD OIL. **Page 284.**

International

What's the oil situation in Algeria? Who's operating? Are there any restrictions on foreign ownership? How about past performance? What about the geology of the area? What does the future hold? Dr. J. Brian Eby, geologist and special WORLD OIL representative, has toured the country and gives these and other answers in *Oil in Algeria*, **Page 317.**

More Pipe Lines for Mexico. Since 1946 Pemex has built more than 1000 miles of crude, products, gas lines. And 500 more miles are approved or underway. The details and pictures of this stepped-up Mexican program on **Page 321.**

Sumatra jungle activities are now in high gear. Held at bay by World War II and succeeding events, the jungle now gives way to roads and oil field sites, pipe lines snake through undergrowth, camps have sprung up—and 33 wells have been completed in the big new Minas field. For a quick survey of Caltex's extensive operations, see *Jungle Oil* on **Pages 324-325**—an on-the-spot picture story.

The 19th International Geological Congress was one of the best. That's what delegates are saying about the meeting which recently ended in Algiers. Turn to **Page 326** for a first-hand report and pictures by an on-the-scene representative of WORLD OIL.

Next outlet for large quantities of Middle East oil may be the Western Hemisphere. Nearly all present production from the Middle East is from nations with equal profit-sharing agreements with their producing concessionaires. These conditions presage continued increased rates of flow, with indications Middle East's oil output soon will be larger than the import requirements of its present largest customers, Western Europe and Africa. See **Page 330.**

. . . . next month

THE STORY OF CANADIAN OIL in 1952 is one of marked success and development. Canada has captured the fancy of those who like to point to the rapid industrial strides possible in a nation whose legal requirements and political climate are conducive to freedom of exploration and exploitation by foreign and domestic interests alike. In next month's special Canadian Issue, WORLD OIL will report in detail the country's drilling, production and pipe line achievements for 1952, together with an analysis of the future which lies in wait for the north's oil and gas. Included in this issue will be detailed oil field maps showing the sizes, shapes and locations of oil and gas fields and pipe lines in all major producing areas.

Looking Ahead

Surplus of crude and products in U. S. could develop unless both domestic and imported oils are sanely fitted into petroleum demand and supply picture. Increased imports are feared by independents, following cut in tariff under Venezuelan trade agreement. Texas independents urge Railroad Commission to pursue policy of fixing allowables relatively high, making domestic crude plentiful, thus trying to discourage imports. Crude production will be at record high under November allowables, although Texas quotas may be cut at mid-month if stocks increase too sharply. High allowables of late 1948 led to surpluses and drastic cuts in quotas in early 1949.

U. S. motor vehicle registrations will reach new high of 53,363,000 by end of 1952, up 2.8 percent over 1951. California will be first state having 5 million, and New York will go over 4 million. Ohio will join Pennsylvania and Texas in having more than 3 million.

U. S. demand for petroleum will go above 10 million barrels daily by 1960. This compares with 7½ million daily in 1952. Remainder of world, excluding Russia, will be consuming 6 million per day by 1960. This will mean a world need for 16 million barrels daily, not counting Russia. World production of crude now slightly exceeds 12 million barrels daily.

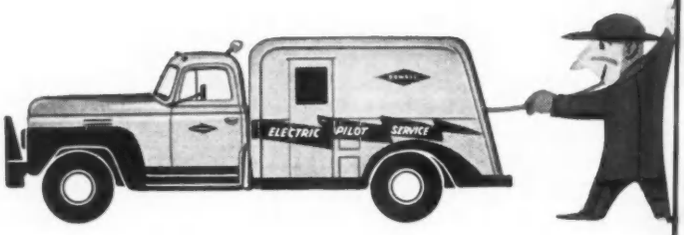
U. S. oil industry must keep adding to investment in facilities, to keep abreast of constantly increasing demand for its products. For every new automobile that goes on the road, the industry now sets up an investment of $765 in producing, refining and distributing facilities to serve that vehicle with gasoline and lubricants. In addition, the industry must invest heavily in other facilities to serve new trucks, buses, tractors, oil burners and other equipment.

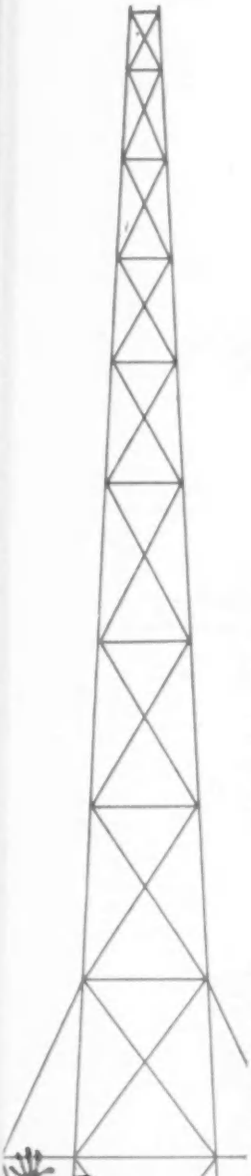
Continued big-scale development is indicated for Williston Basin, where oil companies in 1952 are spending $24 million, or $2 million per month. Expenditures bring new prosperity and long term growth to area and strengthen national economy by increasing nation's oil reserves and productive capacity.

High compression engines will lower automobile gasoline consumption per mile 35 to 40 percent within six years, predicts Dr. Charles F. Kettering of General Motors Corporation. Instead of doubling by 1975, as some estimates indicate, gasoline consumption consequently will be only 1¼ times current consumption, he added. Kettering foresees continued use of gasoline powered cars for at least 25 years but predicts that solar energy eventually may replace conventional fuels.

Petroleum will be the basic source of supply for half the chemicals made in U. S. This will be brought about through expansion of petrochemical industry via additional capital investment of $8 billion. Present investment is $2 billion. Presently engaged in petrochemical industry are over 70 oil and chemical companies, operating or building some 130 plants. Sales now are on basis of over 17 billion pounds annually, with value of over $1½ billion. Future of the industry is very promising, because of great variety of uses for new plastics, fibers and other products it is making and developing.

better guide to more oil?





LOOK TO

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SELECTIVE ACIDIZING—Pilot is used to direct acid into selected zones to get best treatment results. As many as *three separate* zones can be acidized selectively in *one* operation. Also used to protect casing seat during acidizing.

PERMEABILITY SURVEYS—Pilot is used to show location of permeable zones and their capacity to take fluid in relation to other zones, especially as a guide to selective acidizing. Also used to locate leaks around casing shoes, leaks in cement plugs and holes in casing.

SPINNER SURVEYS—Pilot is used to measure relative capacity or production of zones exposed in producing or input wells—as a guide in selective acidizing, for example. Also used to locate zones of lost circulation, casing leaks and circulated shoes.

WATER LOCATION—Pilot is used to locate points of water intrusion into wells, a prerequisite to successful completion and workover programs. The latest water location method uses photoelectric cell.

PERFO-JET—Pilot is used to control casing perforating and open hole shooting with Perfo-Jet's shaped charges. Dowell Perfo-Jet guns are available in a wide variety of sizes and types including the famous Glass Gun.

CALIPER SURVEYS—Pilot is used to give information on well bore diameters and irregularities. Caliper automatically records diameters as large as three feet and shows variations as small as pipe collars—a fractional part of an inch.

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False Charges

THE PETROLEUM INDUSTRY has served the American public in a remarkable manner, providing it with an abundance of low cost, convenient fuels. No other industry has contributed more to the nation's great progress in the past century. To a considerable extent, oil is responsible for the sweeping revolution in manners, customs, mode of living and in business affairs.

Because this nation always has enjoyed the largest and cheapest supply of petroleum in the world, it has adopted the automobile and airplane to a degree not matched elsewhere. This development has decentralized the pattern of residential community and retail trade, thereby redistributing and reshaping our industry, our economy and our population. Without this abundant and cheap supply of oil, modern mass production and the machine-age economy would grind to a sudden halt. Oil has made a great many other contributions to the progress of civilization during the past century.

• • •

THEREFORE, IT IS SURPRISING and downright shocking that many public officials repeatedly charge oil as being a monopolistic villian enjoying high prices, fabulous profits, special tax favors, and as not paying its share of taxes.

Such charges are far from true. They are deliberate falsehoods made to mislead the public. On the contrary, factual information, documented by official statistical evidence, completely refutes any allegations that the industry's prices are high, that the industry enjoys inordinate profits and tax loopholes, and does not pay its fair share of taxes.

• • •

THE TRUTH IS that the price of crude oil and its products has been continuously way below the average price of other commodities since 1926. The national average price for crude oil today is $2.56 per barrel compared with $1.88 in 1926. Bureau of Labor statistics show crude oil prices are only 36 percent above 1926 levels whereas the wholesale price index for all commodities is 76 percent greater. Furthermore, the national average retail price of gasoline, exclusive of taxes, is 20.3 cents per gallon today or one-half cent less than in 1926! In 1926 employes of manufacturing companies had to work 3¾ hours to earn enough to buy ten gallons of gasoline. Today, they need to work less than 1¼ hours to earn enough to purchase ten gallons of gasoline.

Data from the U. S. Department of Commerce shows that out of each dollar of sales made in the years 1942-1949, the oil and gas producing industry paid considerably more in federal and state income taxes and excess profits than the average paid by all other industries, and that oil and gas producers received less profit than the average of all other corporations.

It should be remembered that only one out of every nine strictly wildcat wells finds oil and that many of those which discover oil do not find it in sufficient quantity to be profitable. It is significant that 40 percent of all wells drilled, including those located in proven areas, are dry holes. These facts, coupled with the knowledge, that the average well completed by the industry since 1936 has developed only about 80,000 barrels of oil, is sufficient to answer those who think there are fabulous profits in oil production.

• • •

WE MUST REALIZE there are those who believe the government should own all natural resources. We must realize many think they prefer some form of statism. We must realize that these people know it is necessary to first discredit the American free enterprise system, and that such false charges against oil are an important cog in this effort. Finally, we must realize that we face a real danger.

Warren L. Baker

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The Changing Panorama

This $700 Billion Government Spending Spree Is All on You

THE U. S. GOVERNMENT during the past 20 years has spent $700,000,000,000.00. Lest the zeros make you dizzy, call it $700 billion or nearly $¾ trillion, using astronomical units, in keeping with the spending. That's an average of $35 billion a year. It is equivalent to roughly $20,000 per family for the whole period or $1000 per family per year.

The spending has been so great that it has far outrun revenue from taxes, despite the high rates of taxation. To cover expenditures of over $250 billion, or $6750 per family, deficit financing was necessary. In effect, much of this was raised by floating printing press money, based on government IOU's sold to banks.

The $250 billion deficiency has been paid for by the people, not through taxes, but through devastating shrinkage of the buying power of the dollar. Dollars on deposit in banks, in insurance policies, in government bonds, in corporation bonds, in mortgages, in pension payments and in all forms of fixed income.

Into the prewar supply of dollars, fully backed by assets and worth 100 cents each, have been floated billions of dollars not backed by any real assets. To a pint of milk has been added a pint of water. While there's now a quart of "milk," the new milk is only half as nourishing as the old. All the dollars, old and new, are mixed together. Each now has only half the purchasing power of the prewar dollar.

Talk of free spending by painlessly owing the national debt to ourselves or of passing it on to our children and grandchildren is nonsense. Spending is the disbursement of dollars. The government cannot spend dollars unless it has them. It cannot have them unless it gets them. It can get them directly only by levying taxes or borrowing from the people who have them. If it does not get them directly in those ways it must get them indirectly, if not quite ethically, by "selling" bonds to banks, having the banks set up "deposits" for the account of the government from the "proceeds" of the "sale" of the bonds, and then writing checks on the account, payable to contractors and others.

To get dollars for spending in this indirect and easy way, the government does not pass any burden on to posterity. Through inflation of money supply, without proportional expansion of production of goods to buy with the money, there is depreciation of the buying power of the dollar, and the government dumps the burden of its deficit spending directly upon the current generation of citizens. What they don't pay in taxes, they must pay promptly by accepting governmental discounting or partial using up of the buying power of their savings accounts, bonds, and other assets of fixed value; such holdings being in effect marked down in real value through the government's deficit financing.

It's your earnings they're spending, as you earn, and your savings they're dissipating, as your earnings fail to provide tax revenue in line with the spending.

Employes' Ideas Paying Off in Two Ways

BOTH EMPLOYE and oil company benefit tangibly when the company has and actively promotes a "coin your ideas" program. Thousands of dollars are paid each year to employes who offer new ideas to save money or improve operations. The companies benefit to an even greater extent through savings and improved methods.

The advantages of such a program are demonstrated in the experience related by Socony-Vacuum Oil Company. The company started the suggestion system four years ago among its 43,000 employes in the U. S. Almost half of the employes have submitted ideas.

The company has adopted 703 ideas submitted by employes. These ideas have saved the company money through improved operations. Suggestions adopted for which no actual or immediate savings return can be calculated totaled 3963, including 1666 aimed at improving safety. These, the company reports, result in important aggregate benefit because "the great advances in industry are usually the accumulation of many small improvements rather than by single dramatic changes."

At present about 30 percent of all ideas processed are being adopted by the suggestion system's awards committees throughout the country. The minimum award for an idea that is adopted is $10. So far six awards have exceeded $1000, while the largest award granted to date for a single idea is $3500.

New WORLD OIL Service To Help Busy Reader

As a new service to the busy oil man WORLD OIL, beginning with this issue, is devoting three pages immediately following its editorial index, to a fast moving digest of its principal articles (See Page 2). The purpose is to help readers select which articles they wish to read first, what will be of secondary interest and what articles may not be of particular interest to them. We know, of course, that an article which will be of vital interest to one oil man might not interest another.

The Printed Word Holds Advantage

The twentieth century has seen marvelous advancement in the presentation of ideas, news and entertainment. First, the radio and now the television.

But the serious business man who reads his business paper finds in it one tremendous advantage that, television, for instance, can never hope to match. Dramatic though television may be, the person using it cannot turn back the page and get a repeat when he needs it!

Report from the Observatory

Too Much Crude Being Produced

By **RAY L. DUDLEY**, Publisher, and **WARREN L. BAKER**, Editor

TOO MUCH CRUDE is available. Too much is being produced domestically, and too much is being imported. The industry's economic situation was dealt a serious blow by boosting of Texas' October and November permissible production rates. Excessive crude stocks will accumulate, unless Texas production is reduced in coming months.

High import rates further complicate the outlook. In averaging 951,500 barrels daily during the four weeks ended October 13, imports were 175,000 barrels greater than during the corresponding period of 1951. Most of the increase was in crude oil, which was 144,000 barrels above year ago levels in averaging 647,700 barrels per day during the same four weeks. Reduced importation rates also would help.

Larger domestic production and imports will make approximately 450,000 barrels of additional crude available daily in November than a year ago. This increase is not required in view of a slowing down in the rate of growth of consumption and large stocks.

The crude situation is aggravated by reductions in U. S. crude runs to refineries, following a rapid build-up of refined product inventories to ample volumes as a result of peak refining operations in August and September. With adequate refined product supplies on hand, refining operations declined in October and will continue below earlier levels. This will lessen the need for crude.

• • •

NOVEMBER CRUDE PRODUCTION will be even higher than the October all-time high despite present warnings of a surplus. Reductions in the high crude oil inventories accumulated during the refinery strike last spring already had been checked due to increased production and imports in September and October. Consequently, the additional production increase set for November, together with prospects for substantial reductions in refinery runs, promise to create burdensome stocks of crude—especially if imports continue growing.

Prospects are for U. S. production of approximately 6,600,000 barrels of crude daily in November as compared with slightly over 6,500,000 barrels in October and 6,270,000 barrels in August. Texas is expected to produce about 100,000 barrels per day more in November. With inventories leaning toward the high side with 265 million barrels in tanks, additions to crude stocks could boost them to excessive volumes quickly.

Refinery runs during November are likely to remain under 6,900,000 barrels daily compared with more than 7,000,000 barrels per day in September and August, indicating higher Texas production will cause an immediate increase in crude inventories.

• • •

REDUCED ALLOWABLES during the early part of 1953 become a definite prospect for Texas producers as a result of high October and November producing levels. The situation is similar to early 1949, when production was reduced sharply after Texas had advanced its output to record levels in late 1948. This will be of greater harm than if Texas' November allowable had been reduced slightly and production kept on a more even keel than now will be possible.

A careful and thorough study of the industry's economic position needs to be made by operators and the Texas Railroad Commission members at the statewide hearing November 14 before determining the December production allowable. Trends in the interim may indicate the desirability of the commission ordering an immediate reduction in Texas production rather than waiting until the first of December. This would prevent the situation from getting completely out of hand.

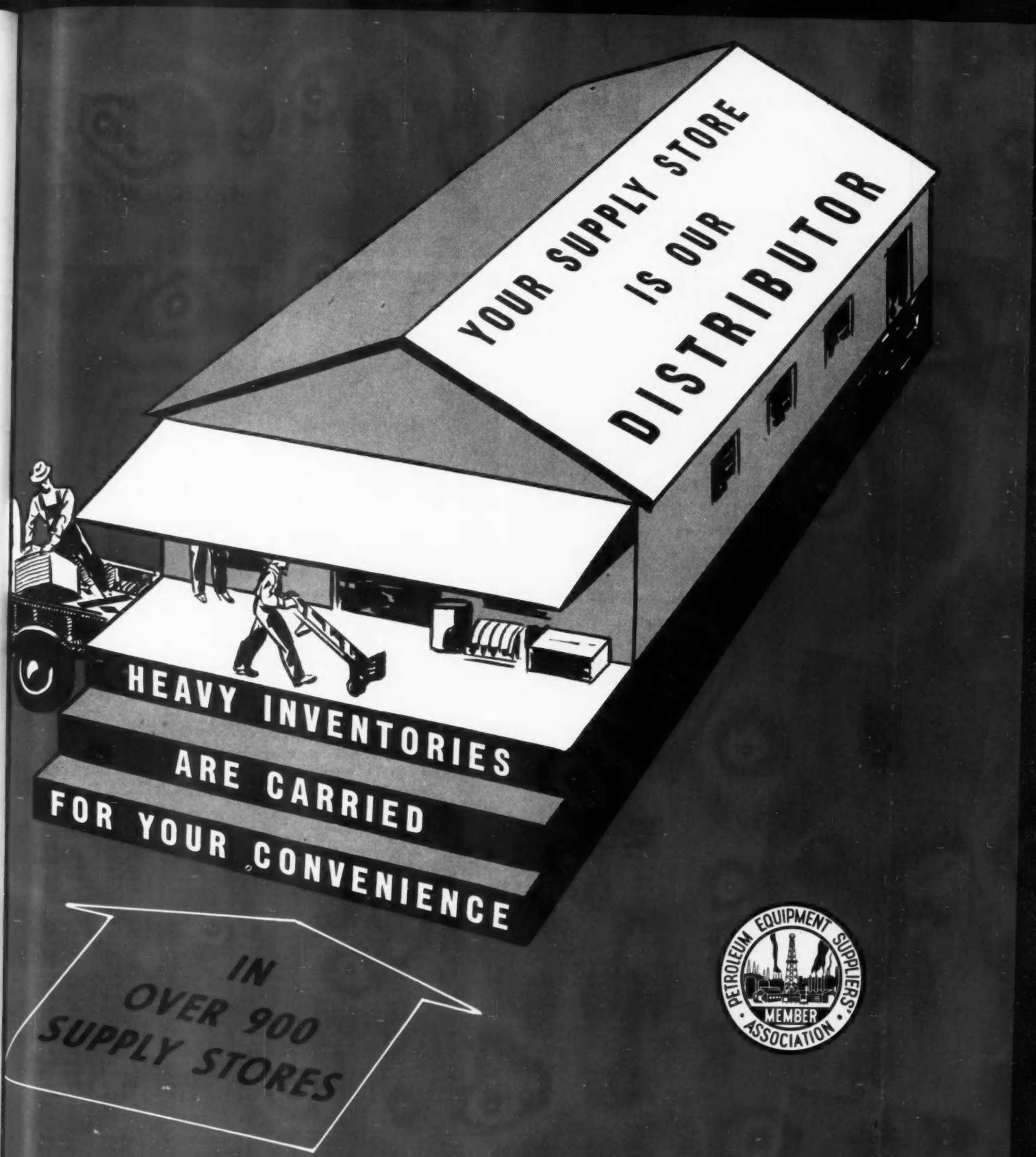
• • •

ADEQUATE REFINED PRODUCT SUPPLIES now exist. Sufficient distillate fuel is on hand for winter months. U. S. inventories of distillate on October 18 reached an all-time high of 121 million barrels, 13 million barrels greater than a year ago. The very rapid growth in these stocks does not need to be continued in view of current inventory levels despite anticipated greater consumption.

Fortunately, 9 million barrels of the increase in distillate inventories are located in the heavy consuming East Coast area. The Gulf Coast region, principal supply source for the East Coast, has 2 million more barrels of distillate than a year ago. The also heavy consuming Mid-Continent region (Oklahoma-Kansas-Illinois-Indiana) has 4 million more barrels of distillate in storage tanks than at this time a year ago.

Present inventories of gasoline now are practically the same as existed at the beginning of the 1951 winter. This is considered satisfactory, with the exception of Mid-Continent stocks being higher than usual.

With adequate refined products in storage, refinery operating schedules can be held below the 7 million-barrel-per-day rate of last July, August and September. This will minimize the possibility of too much gasoline being accumulated during the winter season. However, this increases the possibility of crude oil stocks being pushed to undesirably high volumes.



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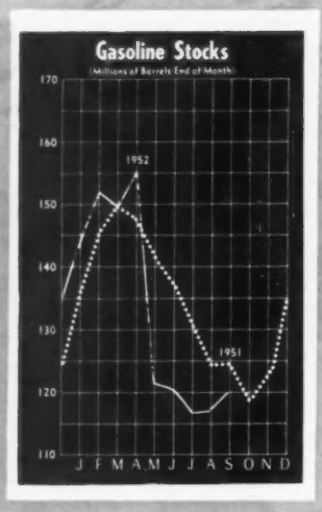
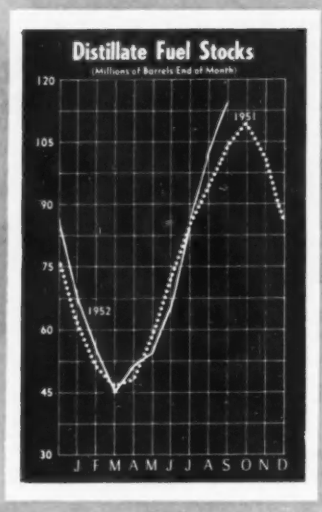
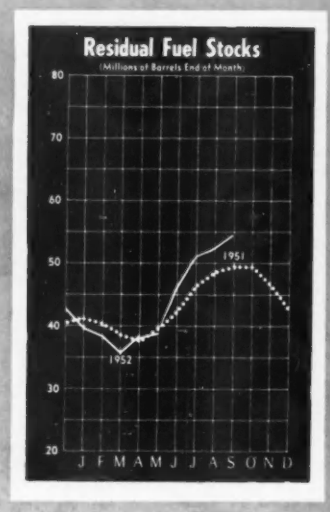
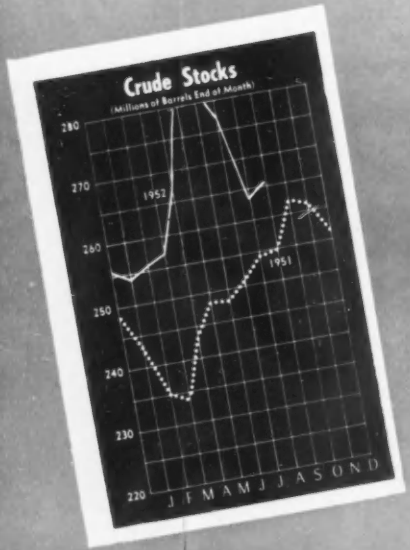
Petroleum

By CECIL W. SMITH,









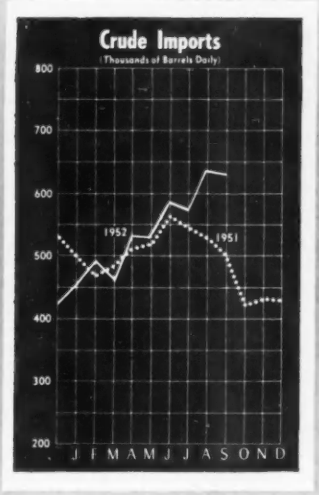
U. S. Crude Production by States

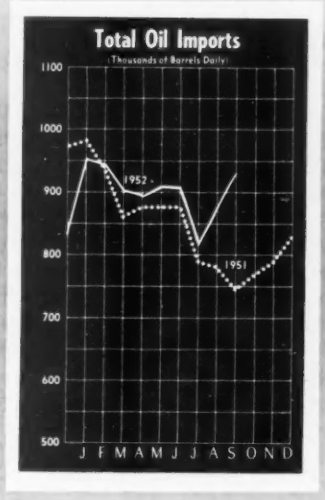
(THOUSANDS OF BARRELS)

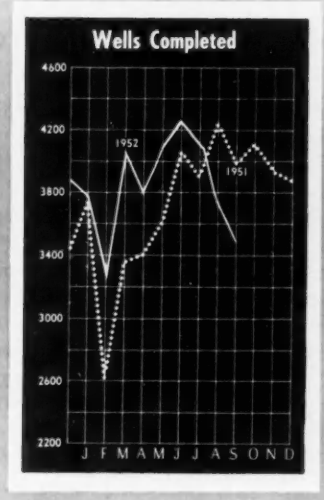
STATE or DISTRICT	DAILY AVERAGE PRODUCTION				TOTAL PRODUCTION First Nine Months		
	September, 1952	August, 1952	September, 1951	% Diff. September, '51-'52	1952	1951	% Diff. '51-'52
Alabama	2.9	2.9	2.8	+ 3.6	707	772	— 8.4
Arkansas	75.6	77.0	82.0	— 7.8	21,814	22,263	— 2.0
California	982.5	984.8	981.0	+ 0.2	268,773	264,309	+ 1.7
Colorado	86.9	83.8	75.6	+ 14.9	21,713	20,159	+ 7.7
Florida	1.6	1.7	1.7	— 5.9	460	443	+ 3.8
Illinois	168.5	167.7	154.9	+ 8.8	43,860	43,797	+ 0.1
Indiana	33.8	33.4	32.4	+ 4.3	8,890	7,729	+ 15.0
Kansas	334.7	323.0	322.3	+ 3.8	84,046	85,545	— 1.8
Kentucky	32.1	32.7	36.1	— 11.1	9,300	8,368	+ 11.1
Louisiana	670.0	668.2	634.2	+ 5.6	178,136	172,741	+ 3.1
North Louisiana	112.5	116.0	113.5	— 0.9	31,923	32,293	— 1.2
South Louisiana	557.5	552.2	520.7	+ 7.1	146,213	140,448	+ 4.1
Michigan	36.2	38.6	37.0	— 2.2	10,169	10,563	— 3.7
Mississippi	95.8	96.2	100.2	— 4.4	27,001	27,768	— 2.8
Missouri	0.1	0.1	0.1	.....	18	22	— 18.2
Montana	27.1	26.9	25.2	+ 7.5	6,736	6,717	+ 0.3
Nebraska	7.8	7.0	5.7	+ 36.8	1,622	1,901	— 14.7
New Mexico	162.8	158.3	148.7	+ 9.5	42,601	38,998	+ 9.2
New York	13.3	13.4	11.2	+ 18.8	3,327	3,176	+ 4.8
North Dakota	4.9	5.3	0.1	+ 4800.0	625	13	+4707.7
Ohio	9.0	8.7	7.9	+ 13.9	2,391	2,362	+ 1.2
Oklahoma	533.1	530.2	516.0	+ 3.3	142,652	139,131	+ 2.5
Pennsylvania	28.2	27.9	28.9	— 2.4	8,326	8,505	— 2.1
Tennessee	0.1	0.1	.....	.....	7	11	— 36.4
Texas	2,971.1	2,785.8	2,858.0	+ 4.0	754,253	747,533	+ 0.9
Dist. 1—South Central	35.3	33.3	33.8	+ 4.4	9,020	9,064	— 0.5
Dist. 2—Middle Gulf	172.9	154.6	169.6	+ 1.9	42,047	44,476	— 5.5
Dist. 3—Upper Gulf	501.5	468.9	508.6	— 1.4	121,919	134,649	— 9.5
Dist. 4—Lower Gulf-S.W.	272.5	249.2	263.6	+ 3.4	68,626	69,560	— 1.4
Dist. 5—East Central	50.2	45.8	57.2	— 12.2	14,892	14,205	+ 4.8
Dist. 6—Northeast	397.8	384.7	397.7	.....	105,860	106,185	— 0.3
Dist. 7-B—North Central	105.0	97.9	83.7	+ 25.4	24,633	22,419	+ 9.9
Dist. 7-C—West Central	173.4	153.5	115.0	+ 50.8	37,317	27,465	+ 35.9
Dist. 8—West	997.0	937.8	993.0	+ 0.4	253,398	253,470	.....
Dist. 9—North	183.1	178.1	159.7	+ 14.7	44,451	42,243	+ 5.2
Dist. 10—Panhandle	82.5	82.1	84.8	— 2.7	22,436	24,085	— 6.9
Utah	5.0	4.7	3.9	+ 28.2	1,248	1,018	+ 22.6
Virginia	0.1	0.1	.....	.....	12	9	+ 33.3
West Virginia	6.8	6.8	7.4	— 8.1	1,930	2,065	— 6.5
Wyoming	196.0	188.7	187.2	+ 4.7	49,808	51,202	— 2.7
Total United States	6,486.0	6,274.0	6,260.5	+ 3.6	1,690,425	1,667,120	+ 1.4

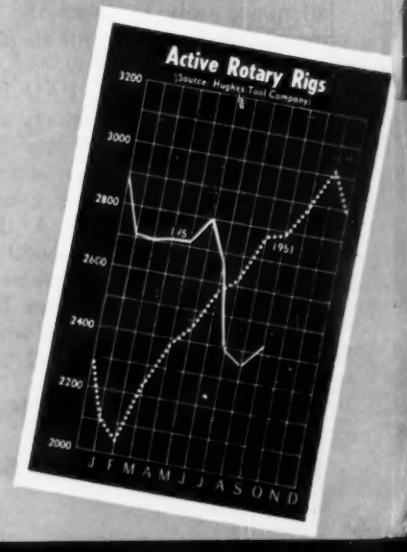
Trends in U. S.

WORLD OIL Staff









Crude Oil and Refined Products Trends

(THOUSANDS OF BARRELS)

MONTH	CRUDE OIL			GASOLINE		DISTILLATE FUEL		RESIDUAL FUEL		DAILY IMPORTS	
	Production Daily	Runs to Stills Daily	Stocks End of Month	Production Daily	Stocks End of Month	Production Daily	Stocks End of Month	Production Daily	Stocks End of Month	Crude Oil	Total Oils
1950:											
July	5,484	5,882	240,270	2,835	111,055	1,040	62,555	1,140	42,165	486	806
August	5,665	6,067	237,393	2,932	107,067	1,089	68,426	1,148	40,979	501	839
September	5,888	6,059	242,311	2,849	105,748	1,180	78,270	1,178	41,966	525	859
October	5,900	6,077	246,424	2,875	105,764	1,217	85,643	1,250	45,004	510	896
November	5,891	6,085	250,016	2,859	109,005	1,218	86,113	1,240	45,048	466	891
December	5,719	6,143	248,463	2,879	116,769	1,343	71,948	1,306	40,750	530	974
1951:											
January	5,907	6,450	243,107	2,962	136,145	1,427	62,163	1,368	41,251	499	977
February	5,930	6,562	235,247	2,906	145,184	1,419	51,348	1,382	40,716	468	937
March	6,052	6,469	233,824	2,908	149,679	1,327	46,744	1,348	38,366	483	861
April	6,127	6,183	243,180	2,821	147,679	1,171	48,239	1,230	37,623	511	871
May	6,170	6,436	248,418	3,031	141,658	1,210	59,272	1,265	39,879	518	876
June	6,130	6,575	248,170	3,100	137,009	1,254	72,140	1,277	42,398	563	876
July	6,141	6,462	250,847	3,091	130,931	1,228	84,282	1,275	46,320	546	788
August	6,232	6,539	254,276	3,114	124,202	1,237	94,028	1,226	48,365	529	780
September	6,261	6,558	254,900	3,127	124,530	1,282	104,082	1,228	49,608	500	744
October	6,375	6,446	262,266	3,105	118,864	1,295	109,544	1,224	49,573	421	769
November	6,272	6,609	261,100	3,130	122,723	1,358	101,666	1,304	46,491	425	802
December	6,182	6,646	255,783	3,150	134,867	1,442	86,619	1,313	42,853	423	834
1952:											
January	6,217	6,640	254,007	3,094	144,339	1,456	66,969	1,338	39,523	488	951
February	6,367	6,673	255,900	3,109	151,912	1,528	55,369	1,322	38,295	491	940
March	6,388	6,640	259,126	3,069	160,689	1,400	48,750	1,274	37,971	510	947
April	6,429	6,436	270,679	2,995	151,890	1,312	51,634	1,253	38,561	539	922
May	5,107	4,905	290,813	2,295	123,656	982	51,648	979	38,821	545	951
June	6,197	6,825	285,964	3,169	120,166	1,455	65,911	1,228	45,688	581	911
July	6,093	6,927	275,951	3,295	116,566	1,475	85,775	1,237	52,245	597	892
August	6,274	7,086	266,454	3,326	117,181	1,473	102,871	1,267	52,436	647	876
September	6,486	7,018	265,152	3,388	120,069	1,481	116,163	1,243	54,597	635	933
Sept., 1952: Change:											
In Month	+212	−68	−1,302	+62	+2,888	+8	+13,292	−24	+2,161	−12	+57
In Year	+225	+460	+10,252	+261	−4,461	+199	+12,081	+15	+4,989	+135	+189
Week Ended:											
10-18-52	6,528	6,898	266,466	3,307	122,092	1,455	121,143	1,202	54,450	762	1,095
10-20-51	6,353	6,481	258,208	3,120	121,450	1,352	108,593	1,215	50,537	335	588

Monthly News Analysis

Big Demand for Steel Pipe Is Indicated for Several Years

Large requirements of steel pipe of small as well as larger diameter are indicated for the next several years, for purposes of drilling and equipping wells for pumping and connecting them with pipe lines. The needs currently are being forecast in considerable detail in connection with government control of steel supplies.

Petroleum Administration for Defense currently is working on estimates of drilling in 1954 and 1955, as requested by Defense Production Administration, which earlier this year approved a program of drilling 55,000 wells in 1953. PAD recently indicated that drilling activity in future years may not be as high as it once believed. Besides the availability of steel, there are other factors that will influence volumes of drilling, PAD said, including the willingness and ability of the industry to undertake further expansion. It pointed out, for example, that financing has become an important problem for some companies, as they already have been carrying on record expansion of facilities.

When 1954 and 1955 drilling programs are announced, they may show moderate increases over the current 55,000 wells annual rate but smaller gains than would be necessary to give the industry the ability to meet all-out requirements. When the present program of drilling 25,000 wells in the latter half of 1952 and 55,000 in 1953 was announced earlier this year, PAD said the program would be adequate only to meet the current, increasing demand and to provide a small cushion of safety.

In late October, PAD indicated that any ideas of relatively sharp increases in drilling in the next few years might have to be toned down, in line with a possible conservative attitude in the industry. At that time, PAD specifically questioned whether there would be fulfillment of estimates by an industry pipe line committee that the industry would drill 60,000 wells in 1954 and 65,000 in 1955.

Those estimates had been made prior to the middle of October by a committee for 41 pipe line companies, headed by J. L. Burke, Tulsa, president of Service Pipe Line Company. The estimates were used in making forecasts of line pipe requirements for connecting pipe lines with the new producing wells to be completed during the next few years. While questioning the well completion estimates, PAD commended the committee for developing useful formulas for relating wells drilled to wells that will be connected by pipe line and for computing average tonnage and footage of pipe needed to connect a new producing well. PAD said the data would greatly help that agency in determining what requests it should make to DPA for line pipe.

The pipe line committee had estimated that pipe required to connect each new oil well to a pipe line outlet averages 1660 feet of diameter of 10 inches or less, weighing an average of 14.16 tons. The committee reported to PAD a critical need for small diameter pipe by crude oil and petroleum products pipe lines, and stated that requirements for the next three years are likely to increase substantially. It said that the supply of salvage pipe in the ground is diminishing, less than half as much being available for taking up in 1952 as in 1951, and further decreases being in prospect in 1953 and subsequent years. The committee also called attention to the current existence of a serious shortage of thin wall pipe.

Crude Price Lids May Retard Expansion

Ceilings on prices of crude oil are being deplored in the industry as a factor that will discourage essential expansion and drilling and possibly prevent fulfillment of defense program drilling goals.

The oil well drilling program scheduled by defense agencies could fail to be met because of the unfair and inequitable freeze of crude prices and regardless of the supply of materials. This warning was sounded by committees of the Independent Petroleum Association of America at its annual meeting in Oklahoma City October 23.

While the Office of Price Stabilization has maintained an inflexible freeze on crude oil prices, other prices and wages affecting petroleum costs have been permitted to increase substantially, the IPAA committees on prices and materials stated.

As a result of strikes in the petroleum and steel industries in 1952, increases in wages were authorized. The wage increase in the steel industry resulted in further increases in the cost of materials used by oil producers, particularly tubular goods. The regular price of tubular goods has increased 35 to 40 percent since the last change in crude oil prices in 1947, said the price committee. In addition, many producers are paying twice these prices to obtain foreign pipe imported into this country and conversion pipe produced at abnormal costs.

"This record of price and wage controls has been one of rank discrimination against the oil producing industry," declared the committee. "When and if World War III strikes," it warned, "the people of this nation should know that bungling and unrealistic administration of price controls has been the real cause for any lack of sufficient oil to defend our country." The committee charged that the price controls on crude petroleum "are unsound, unnecessary, discriminatory and illegal."

IPAA's committee on materials said price controls could prevent achievement of drilling goals regardless of the supply of materials. It stated that the recent steel strike alone resulted in a six percent price hike in pipe.

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AK-511

Natural Gas Problems Derail Federal Price Control Program

The federal government's price control program is running into several knotty problems in the natural gas industry, and the way these problems will be settled is a matter of importance to natural gas producers.

A big question has been raised for the price controllers by the escalator clauses in contracts for sale and purchase of natural gas. Some contracts are calling for increases that will step wellhead prices up above the ceilings that have been ordered by the Office of Price Stabilization. To complicate this problem, some companies have the fair commendable policy of also making the "escalator raises" applicable to purchases of gas from owners of adjacent wells. OPS declares that this general raising of prices in line with raises in one contract is a situation that particularly calls for correction.

OPS has considered putting a flat ceiling on the increase to be permitted within different areas. Whether this voiding of contracts would be legal is questioned. An alternative considered by OPS is to allow producers with escalator clauses in contracts during the price control base period to obtain the increases provided for but to prohibit increases for other producers in the area based on that contract. A third alternative for OPS, it says, is to do nothing in the matter. But the agency considers action of some kind necessary and is expected to initiate some restrictions in regard to the escalation contracts.

A second major problem that OPS is encountering in putting ceilings on prices of natural gas at the wells is that of conflict with floors that several states put under natural gas prices. Kansas and Oklahoma have laws authorizing their conservation commissions to prescribe minimum wellhead prices for gas.

The laws are intended to promote conservation.

Southwestern Kansas Royalty Owners Association has petitioned Kansas State Corporation Commission for a minimum price of 12 cents per thousand cubic feet in Hugoton field. OPS has put pressure on the Kansas commission, urging it to deny the request because the proposed legal minimum price would be in excess of ceiling prices established by OPS in Kansas, Oklahoma, and Texas. OPS ceilings in no case exceed 10 cents in that area.

OPS expressed the view that fixing of the minimum price by the commission, as requested, would have serious consequences for the stabilization program. The Hugoton field extends from Kansas into Oklahoma and Texas, and this fact could lead to other complications besides the conflict between state and federal price fixing. This possible complication was pointed out to the Kansas commission by OPS. It would be the probable prompt spread of price increases into Oklahoma and Kansas. For it is becoming customary in the gas industry for purchasers to follow the "in line" practice (previously discussed), making the increases that are granted to one producer in a field applicable also to all other producers in the area.

The workings of supply and demand and free prices are complex and sensitive to many forces, many of which are not readily perceived or understood. When price controllers attempt to substitute their discretion and will for those normal controlling forces in an industry's economy, their inadequacy for the job promptly becomes evident.

Supply and Demand Increases Forecast

Total demand for all oils in 1953 for U. S. domestic use and export will average 7,967,000 barrels daily, an increase of 3.3 percent over 1952. Domestic consumption will average 7,674,000 barrels per day, or 4.9 percent more than in 1952. These rates are forecast by the supply and demand committee of the Independent Petroleum Association of America in the only such estimates made by any industry group.

The 1953 total demand of 7,967,000 barrels daily (domestic and export) will include: gasoline 3,355,000 barrels per day, kerosine 378,000, distillate 1,483,000, residual oils 1,618,000, and other products 1,133,000 barrels.

Based on estimates of total demand and inventory changes, the committee said total required supply in 1953 would average 7,994,000 barrels a day. Inventories of crude oil and refined products, reported standing at 681 million barrels last September 30, will drop to 626 million barrels by next March 31 and then bounce back to 698 million barrels on Sept. 30, 1953. On this basis, inventories will be drawn on at the rate of 302,000 barrels daily to meet peak demands this winter, but additions next summer will average 393,000 barrels daily.

The forecast noted that estimated new supply in September, 1952, totaled 8,045,000 barrels daily, including domestic production of 7,110,000 barrels and imports of 935,000 barrels of crude oil and refined products. "It should be noted that total supply of all oils during September was greater than that which the committee estimates as being necessary, on the average, for the year 1953," the report said.

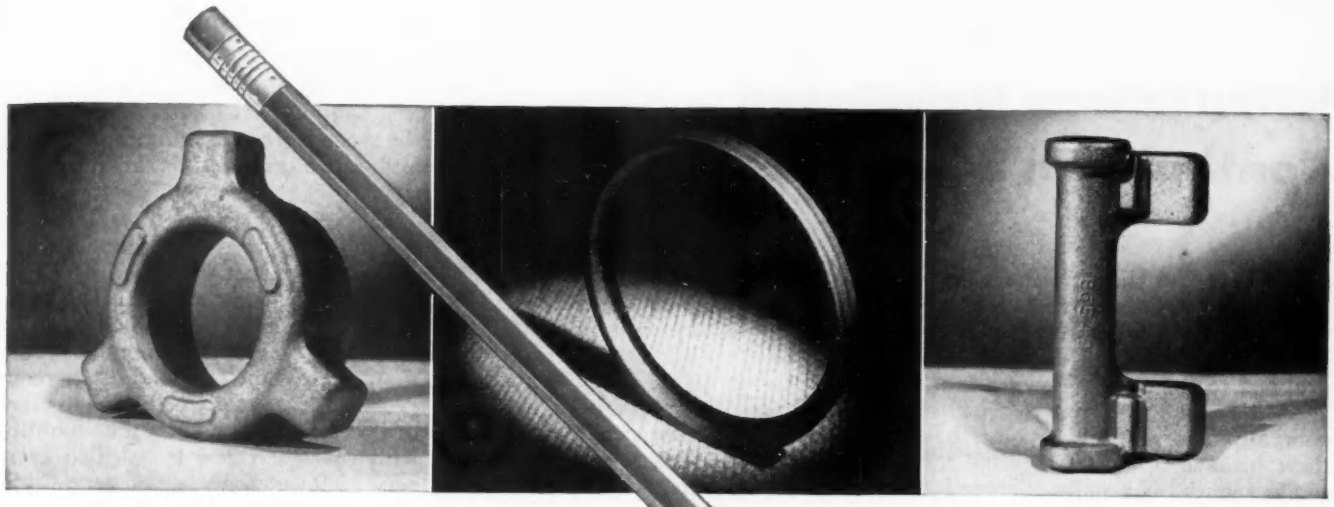
The committee also forecast total domestic and export demand for the six months ending March 31, 1953. It said demand for this period would total 8,339,000 barrels a day, or 4.2 percent more than in the same period a year ago.

More Oil Due

A further increase in U. S. crude oil production to a new high is in prospect, in view of the Texas Railroad Commission's proration order for November. Allowable crude production for November was set at 3,372,252 barrels daily, an increase of 87,547 barrels, and a new record quota.

It was conceded at the same time by members of the commission that the new Texas allowable might prove somewhat excessive and lead to surplus stocks of crude and products. But in that event, commissioners stated, there will be an emergency order reducing the state's allowable at the middle of November besides lower quotas for December.

Texas production in November will be based on operation of wells for 23 days in nearly all fields, exceptions being 18 days in East Texas and still fewer days in several other fields.



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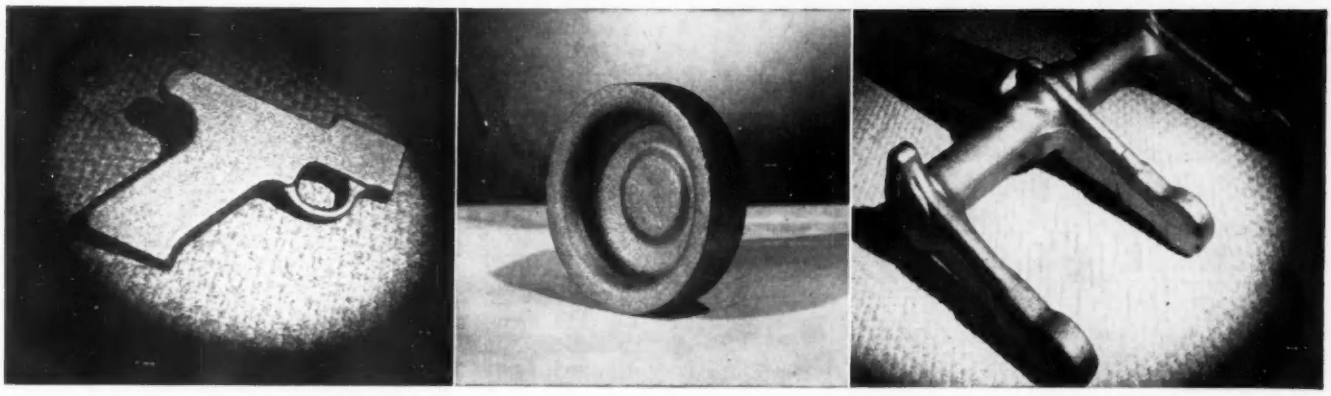

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Completions Downtrend Continues in September

EFFECTS of the pipe shortage on drilling operations were very much in evidence during September when the number of completed wells dropped to the second lowest for this year. Not since February, which is generally any year's low point, have there been so few wells credited to a single month. Normally, September, although not generally the most active month, is among the leaders.

September's total wells were about six percent fewer than had been completed in August, making an overall drop of 16 percent in the past two months. This is the part of the year when drilling normally reaches a peak but the trend has now undergone a complete reversal. The setback can be laid squarely at the steel strike's doorstep.

The seven-month low in completed wells recorded in September totaled 3489 new wells, 233 new tests less than the 3722 finaled in August and 746 fewer than the peak reached in June. The month was second only to February, with its 3244 new wells, as the year's most inactive period.

So far, this has been the most active drilling year in history, but the 4.2 percent lead that total 1952 wells hold over those drilled in 1951, the record year, is rapidly being dissipated. Actually, in the past three months there has been a decline of almost 6½ percent in the number of new wells compared with operations in last year's comparable period. A further drop in the margin that this year holds will be true when October's records are complete. Last year 4111 new wells were finished in October for the second greatest number that year, and far more than is in store this time.

The big difference in this year's drilling operations compared with last year's is the vast increase in footage drilled. So far, a total of 141,639,929 feet have been penetrated in this year's wells and that amount is more than 14 million feet and 11 percent greater than the 127,182,326 feet drilled in last year's first nine months. This year each new test drilled averaged 4099 feet deep, for a new all-time record. A year ago, each well had averaged 3852 feet.

At the end of September, active drilling rigs had risen to 4687 from the year's low of 4508 working at the end of August. Despite the hike during the month, active rigs are still considerably fewer than the 5237 counted at the end of September, 1951.

Wells Completed in the United States During September, 1952, and First Nine Months, 1952

State or District	MONTHLY COMPLETIONS, SEPTEMBER, 1952									TOTAL COMPLETIONS				CUMULATIVE TOTALS January-September					Rigs in Operation (Drilling, Rigging, Up and Shut Down)		
	NEW WELLS																				
	Oil	Dist.	Gas	Dry	Water Input	Gas Input	Water Disposal	Total New	Total Drilled Deeper	Sept., 1952	Aug., 1952	Sept., 1951	Footage Sept., 1952	Wells 1952	Wells 1951	Percent Diff.	Footage 1952	Footage 1951	Sept., 30, 1952	Aug. 31, 1952	Sept. 30, 1951
Alabama	4			1				5		5	5	8	31,161	48	46	+ 4.3	282,790	220,744	5	7	4
Arizona												1		1	3	— 66.7	3,544	6,337	4	5	
Arkansas	18			21				39	1	40	38	40	152,105	308	312	— 1.3	1,134,420	1,075,462	41	43	37
California	126		5	58				189	1	190	225	216	885,985	1,918	1,804	+ 6.3	7,938,266	6,976,304	261	237	277
Colorado	16		3	27				46		46	49	38	239,005	331	192	+ 72.4	1,783,489	932,627	42	43	42
Florida														6	3	+100.0	39,081	14,614	1		1
Georgia																			1	1	
Idaho															1	—100.0		12,844	3	3	1
Illinois	69		4	115				188		188	251	243	477,663	1,510	1,766	— 14.5	3,717,583	4,398,078	190	175	217
Indiana	39		1	58				98		98	128	159	165,241	959	952	+ 0.7	1,696,306	1,730,041	157	132	189
Kansas	147		30	132			5	314		314	257	397	1,073,980	3,197	3,114	+ 2.7	11,087,501	10,641,730	403	408	408
Kentucky	33		18	61				112		112	100	142	214,273	885	966	— 8.4	1,812,674	1,966,874	90	84	103
Louisiana	104	3	23	76				206	1	207	204	219	1,312,828	1,737	1,658	+ 4.8	11,538,457	10,504,129	218	205	231
North Louisiana	66	1	11	44				122	1	123	118	127	489,031	955	921	+ 3.7	3,618,085	3,527,285	70	60	78
South Louisiana	38	2	12	32				84		84	86	92	823,797	782	737	+ 6.1	7,920,372	6,976,844	148	145	153
Maryland			1	2				3		3	4	3	11,758	32	26	+ 23.1	124,967	104,191	11	13	29
Michigan	15		3	24				42		42	58	62	122,242	491	532	— 7.7	1,321,931	1,322,994	89	90	110
Mississippi	6			17				23		23	32	32	155,449	259	273	— 5.1	1,857,082	1,780,353	37	32	37
Missouri			1	3				4		4	2	1	3,149	30	4	+650.0	30,192	2,717	3	3	5
Montana	16		1	22				39		39	28	21	152,664	200	200		647,473	450,694	68	67	58
Nebraska	12			19				31		31	43	22	163,024	174	119	+ 46.2	878,303	555,274	17	14	22
Nevada															2	—100.0		15,431	1	1	1
New Mexico	41	1	40	16				98		98	71	60	541,922	839	510	+ 64.5	4,650,272	2,483,170	173	169	168
New York	69				43			112		112	128	42	154,930	807	401	+101.2	1,120,757	572,373	127	126	58
North Dakota	6			3				9		9	5	1	72,643	42	7	+500.0	375,960	39,182	30	28	7
Ohio	36		9	25				70	1	71	86	81	153,884	714	677	+ 5.5	1,537,152	1,372,710	171	171	155
Oklahoma	200	2	31	161	3		1	398	4	402	531	460	1,477,604	4,365	4,167	+ 4.8	16,155,883	14,913,209	574	540	615
Pennsylvania	62		14	5	59	8		148	4	152	161	143	246,670	1,286	1,139	+ 12.9	2,171,006	1,954,452	277	286	262
South Dakota				1				1		1			3,808	3			16,221		1	2	3
Tennessee															6	—100.0		7,465	5	5	8
Texas	622	26	50	522	1			1,221	18	1,239	1,232	1,534	5,780,655	13,777	13,569	+ 1.5	65,678,056	58,891,818	1,363	1,293	1,829
Dist. 1 S. Central	44	2		41				87		87	56	44	262,067	566	467	+ 21.2	1,666,739	1,292,891	42	33	35
Dist. 2 Middle Gulf	14	3	2	30				49		49	67	73	361,030	615	582	+ 5.7	3,925,172	3,413,918	49	46	58
Dist. 3 Upper Gulf	61	11	12	79				163	1	164	121	123	1,076,069	1,369	1,163	+ 17.7	9,031,224	7,221,708	134	114	144
Dist. 4 L. Gulf-S.W.	47	5	9	40				101		101	116	137	540,237	1,245	1,302	— 4.4	6,595,849	6,395,179	92	89	122
Dist. 5 E. Central	15	2		14				31		31	33	47	160,083	275	368	— 25.3	1,390,117	1,460,921	19	33	29
Dist. 6 Northeast	10	3	11	9				33		33	32	45	209,845	413	534	— 22.7	2,542,942	2,723,249	36	29	41
Dist. 7-B N. Cent	86			104				190	1	191	189	291	579,566	2,086	2,154	— 3.2	6,596,203	6,172,773	137	129	206
Dist. 7-C W. Cent	87		3	36				126	2	128	147	134	733,305	1,646	1,098	—750.1	9,572,148	5,025,735	178	181	220
Dist. 8 West	129			55	1			185	14	199	189	302	1,087,374	2,690	3,022	— 11.0	15,136,759	16,359,751	303	288	567
Dist. 9 North	119			109				228		228	237	219	678,426	2,397	2,175	+ 10.2	7,700,759	6,576,477	299	267	281
Dist. 10 Panhandle	10		13	5				28		28	45	119	92,653	475	704	— 32.5	1,520,144	2,249,216	74	84	126
Utah	3		2	6				11		11	11	3	73,120	57	25	+128.0	367,665	117,444	26	34	31
Virginia																					1
Washington																					1
West Virginia	2		30	8				40		40	59	51	116,660	446	445	+ 0.2	1,323,809	1,285,924	204	210	215
Wyoming	17		1	24				42		42	63	77	214,166	466	569	— 18.1	2,349,089	2,833,141	94	81	112
Total U.S.	1,663	32	267	1,407	106	8	6	3,489	30	3,519	3,771	4,056	13,996,589	34,888	33,488	+ 4.2	141,639,929	127,182,326	4,687	4,508	5,237

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West Coast Becoming Broader Market

• Sharply climbing consumption requires new crude supplies to supplement California output.

• Some crude already being imported from the Far East.

• Western Canadian crude to enter Vancouver and adjacent markets.

• New Mexico and West Texas crudes will help supply southern Pacific coast area.

THE WEST Coast petroleum industry currently is undergoing a historic transition. In the future it will be a broader industry, interrelated with national and international trade in oil. Heretofore, it has been an isolated, self-contained, self-sufficient industry, operating almost wholly on crude oil produced in California and supplying a large proportion of the oils used in the U. S. between the Pacific Ocean and the Rocky Mountains as well as in the Vancouver and adjacent areas of western Canada.

The change of the West Coast oil industry from provincial to international scope is being caused by the phenomenal increase in demand for oil in the region. California's actual and potential crude production have been increased materially, too, but not enough to meet the rapidly expanding demand. The oil requirements have been boosted by natural population growth, large-scale migration of new population into the region from other states, industrialization and relatively large military demand, especially since outbreak of war in Korea.

Scarcity Developed

Scarcity of crude began to develop in 1951 and became more perceptible in 1952. Currently, the scarcity still prevails, and it appears that a tight supply situation is likely to continue in the next few years, even if there is fair success in further expanding California's crude producing capacity. Therefore, steps already have been taken and others are being taken to assure ample oil for the expanding West Coast market by supplementing supplies of crude from California fields with crude from other sources. To meet essential requirements, one major company was importing supplemental crude oil from Borneo in 1951 and also began bringing in limited shipments from affiliates in Sumatra at the middle of 1952.

To help supply the Pacific Northwest, some oils are now provided by Rocky Mountain fields, through facilities built in recent years. These include a products pipe line to serve Idaho, Oregon and Washington points from the refining center at Salt Lake City, using crude from fields of the Utah-Wyoming-Colorado region.

Now in early prospect is another source of supply for the Pacific Northwest. This is the impending flow of Western Canadian crude from Edmonton to the Vancouver area through the Trans Mountain crude line, due to be completed in August, 1953. About half of the expected initial crude throughput of 75,000 barrels daily will be exported to California, the U. S. Pacific Northwest, and other markets, after supplying refineries in the Vancouver area. When three planned pumping stations are in operation, the line will reach its initial capacity of 120,000 barrels daily. It ultimately can handle 200,000 barrels daily. This Western Canadian crude will be put through the line for a transportation charge of 45 cents a barrel. It will have a competitive advantage over crude from the Williston basin, which would have to move farther.

Seeking markets in the southern portions of the West Coast region, in view of indicated scarcity of California crude, is Permian Basin crude from Southeastern New Mexico and West Texas fields. Two different West Texas-California crude oil pipe lines are contemplated. West Coast Pipe Line Company has secured approval of priority designations for steel supplies for a 960-mile line from Wink, Texas, to Norwalk, Calif., which would cost around $100 million and deliver 200,000 barrels of crude per day. L. M. Glasco of Dallas heads the group planning this line. Still hanging fire is the proposed Progress Pacific Pipe Line Company $120 million, 300,000-barrels-per-day crude line, planned by Earl Gilmore, California independent operator, and others.

The most economical source of crude for California is production from its own fields, and the state doubtless will continue to yield important new fields and new pay zones. Discoveries would be stimulated, however, by prompt lifting of government ceilings on prices of crude. Refiners want to pay more for California crude in order to bring out more supplies but at present cannot legally do so. Higher prices would induce producers to put presently idle marginal wells on production, encourage secondary recovery, and stimulate discoveries.

Ample Volume Assured

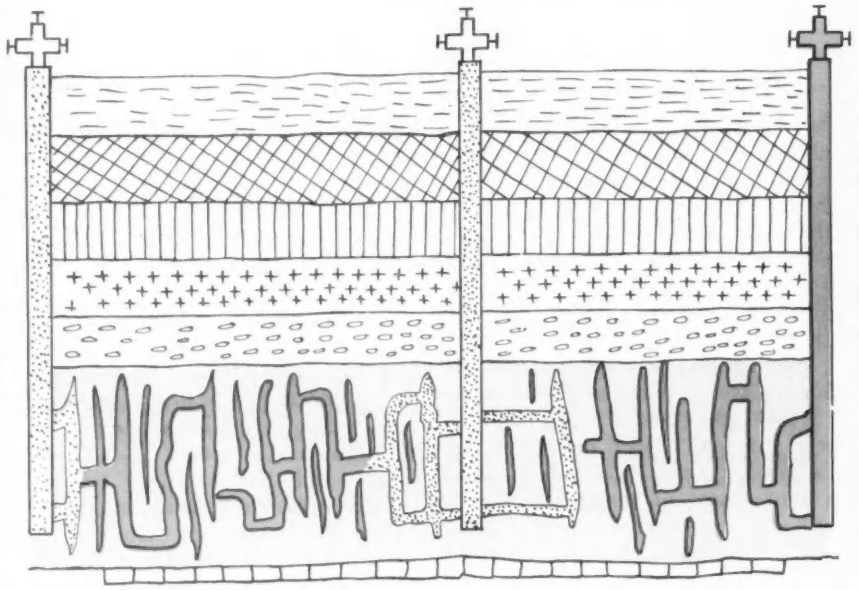
On the basis of presently available supplies of crude from California, the Rocky Mountains, Canada, Texas and the East Indies, the West Coast region is assured of ample volumes of petroleum products for a considerable number of years.

Not presently available but potentially a close-at-hand source of large supply are the Pacific Coast tidelands. Some present fields extend out into the ocean, and when the tidelands ownership question is settled, there will probably be substantial production from the submerged lands. However, tidelands development now is stymied. And it will be a number of years at earliest before offshore wells will contribute materially to the West Coast crude supply.

Oil needs of the West Coast region could be partially supplied if necessary by still another source, the rich deposits of oil-shale in Colorado. Experimental plants have indicated that it would be economically as well as technologically feasible to supply West Coast markets with oils made from the Colorado shales. It is questionable if shale oil can be considered competitive with even the crude that has to be imported. But the synthetic product definitely is a potential source assuring sufficient oils for the West Coast region at realistic prices.

Engineers Search for Key to Unlock Trapped Oil

Only 5 to 10 percent of the oil in the tight, fractured Spraberry sandstone comes into the wells through the natural gas expansion drive. When pressure drops around a well after limited production of oil, gas that is dissolved in the oil comes out of solution, moves into the well ahead of the oil, and locks the oil in the formation. Thus 90 to 95 percent of the originally present oil is trapped in the reservoir. Engineers understand the problem of getting more of the oil to move into the wells, and they hope to find the key to unlock the trapped oil.



Oil in fractures and in well.
Oil in tight Spraberry sandstone.
Gas in fractures and in well.

Can the Industry Recover Hidden Spraberry Hoard?

Here's an optimistic view of a knotty problem involving $2½ billion worth of hard-to-get oil.

By CHARLES J. DEEGAN
Petroleum Consultant, Fort Worth

THE EYES OF Texas are on the Spraberry Trend—so are the eyes of thousands of oil men everywhere. It is no exaggeration to say that some of these people are viewing it with dismay, some with alarm, and almost all of them with some degree of worry.

By now most oil men have heard the verdict of the reservoir engineers on the testimony presented at the recent Texas Railroad Commission hearings. That verdict is that on the basis of the evidence to date, each Spraberry well can be expected to quit producing oil within a short time after the reservoir pressure around that well reaches a bottom hole pressure of approximately 1000 pounds per square inch.

It is believed that this dismay and alarm are not justified. On the other hand, a certain amount of constructive worry is well justified. The Spraberry Trend will be producing a lot of oil five years from now, ten years from now, and even 20 years from now. But to achieve that happy result, a lot of constructive thinking, a lot of hard work, and a willingness to accept and try new ideas and new methods of producing will be necessary. The kind of worrying about the Spraberry that helps to bring about these conditions will be constructive worrying. The end result will probably not be any bonanza profit, but it should result in most Spraberry operators eventually winding up in the black.

Take a look at the dark side of the picture. Because the Spraberry fractured sands are so fine grained, with such low porosity and permeability, we have an unusual combination of conditions within the reservoir. The same laws of physics apply here that apply to most sandstone oil reservoirs with a gas expansion drive. But due to the unusually small size of the pore spaces in the Spraberry, we run into unusual effects.

5-10 Percent Production

The important thing to understand is that when a Spraberry well goes dead, it is not because it has drained all of the oil out of the sand, or even recovered the normal percentage of oil in place that gas drive reservoirs usually yield. There is still plenty of oil in the drainage area of the well. For most Spraberry wells, under present producing methods, the amount of oil that will be produced will range from 5 percent to 10 percent of the oil in place around the well. On an average it is apt to be a little closer to the 5 percent than to the 10 percent. Thereafter the well seems to be unable to produce anything but gas.

The engineers explain this phenomenon in terms of reservoir pressure, capillary forces and the relative permeability of the sand to gas versus oil. This is correct, but unfortunately not clear to many non-technical oil men. For the non-technical oil men, a simpler explanation is that the result is just about the same as having a vapor

lock in the gasoline feed line of an automobile engine.

Most people at some time or other have had the experience of having an automobile engine develop vapor lock and die on them. It is quite apt to happen on a hot day, during or immediately after a long hard climb, particularly in the mountains. Often it happens after the car has been stopped for a short time after driving under such conditions, and then an attempt is made to start again. There is still plenty of gasoline in the tank, the fuel pump is apparently working, the ignition system is functioning, but the car simply won't start.

In an automobile engine the cause is simple and the remedy is also simple. The cause is overheating of the gasoline feed line, which results in the liquid gasoline vaporizing and expanding before it reaches the carburetor. When it expands it builds up a pressure in the line which the fuel pump can't buck. The remedy is to remove the vapor lock by cooling the feed line until the vapor condenses into liquid gasoline again.

Oil Locked In

In the Spraberry sand, when the pressure gets down around a critical point, the gas can still move out of the sand, but the oil is locked in. There is still plenty of oil in the sand, just as there was plenty of gasoline in the tank of the vapor locked gasoline engine. But the oil in the drainage area of the well can not be induced to flow into the bottom of the well by any of the normal operating methods used in most oil fields. Nor does it seem likely that any of the engineering techniques normally used in pressure maintenance, repressuring, or secondary recovery operations will succeed. Something different will be required, and unfortunately working on 500,000 acres of sand, at depths of 6000 to 7000 feet, is not as simple as reaching under the hood of an automobile.

Briefly then, the black side of the picture sums up like this. After producing somewhere between 300 barrels and 1000 barrels per acre, the pressure around a Spraberry well will drop to the critical pressure of approximately 1000 psi., and thereafter that well will produce little or no oil by any conventional producing method.

If this is true—and the reservoir engineers generally agree that it is—what reason is there to have any hope at all? What can be done? The answer to the first question is that there are reasons for hope, some tangible, some intangible. The answer to the second question is that cerain steps can be taken as a temporary remedy; and that other steps have been taken which will require checking and testing in the field.

Temporary Remedy

The temporary remedy is to immediately reduce the investment cost per barrel of recoverable oil under present conditions, by going to wider spacing on the two thirds of the Spraberry Trend acreage not yet developed. The pressure drop around any well tends to follow the amount of oil produced per acre. Therefore a well on 80-acre spacing has a good chance of producing about twice as many barrels before going dead as a well on 40-acre spacing. A well on 160 acres has a good chance to produce perhaps four times as many barrels as the 40-acre well before going dead.

At the moment it looks as though 160-acre spacing ought to show a profit on drilling and operating costs; an 80-acre spacing is perhaps somewhat on the borderline of the break-even point. This isn't too happy a situation, but development drilling on this basis can be and is being done. Furthermore it has the advantage that if anything new in producing methods is developed that permits closer spacing later, the inside locations can then be drilled if they look profitable.

But this doesn't do anything for the operator who has already drilled up his property on 40-acre spacing. Is there any hope for him? The answer is "yes," there is hope, but how and when cannot be definitely answered as yet. There are tangible, solid grounds for hope, and there are also powerful intangible grounds for hope. Suppose we examine the tangible grounds first.

Even if the 40-acre well has reached the critical point and is now dead, there is still a lot of oil in place in its drainage area. This oil is locked in place because certain physical forces which obey natural laws have reached a specific type of balance or equilibrium. These forces have been analyzed, and the situation is understood. In other words, the reservoir engineers know just what the trouble is. Understanding a problem is the first step toward solving it. If the present balance of these forces can be upset, if the equilibrium can be altered in certain ways, it should be possible to get oil flowing toward the well once more.

How to do this is at least a 64 million dollar question, in the sense that easily that much may be involved in oil values. If the answer is found, it will probably be by the reservoir engineers. For a profession only 25 years old at the most, they already have a brilliant performance record and recent indications have been that they are on the threshold of achievements that will dwarf anything they have done in the past. What will they come up with to solve the Spraberry problem?

One method has already been publicly proposed; the Atlantic Refining Company's imbibition process. Briefly the proposal is to inject water into one well. As this water moves through the fractures in the Spraberry sand, the capillary forces involved may cause the water to be imbibed (sucked in) into the sand and result in the release of some oil. Note that the water is not pushed into the oil sand by pressure; it is sucked in by capillary forces. Thus it differs from pressure maintenance by water injection.

Proved in Lab

The imbibition process works on cores in the laboratory. It may or may not work in the field. If it does work, no one is exactly sure how well it will work, how long it will work, or exactly where the released oil will move to.

A field test of this method is to be made almost immediately; possibly even by the time this article is in print. Some engineers are hopeful, some are skeptical. But theoretically at least, the test has one meritorious angle. If it is a complete failure, that result will be known within a week, perhaps with a few days.

If the water pumped into the intake well is not imbibed or sucked into the sand, it should not take long to fill up the fractures around the well and back up into the hole. Therefore if the well fills up and refuses to take a substantial volume of water at a reasonable pressure, imbibition into the oil reservoir is not taking place. If the well does take water in substantial volume at a reasonable pressure, then that water is going somewhere, presumably being

imbibed into the oil sand, and should permit oil to move out. How much and how long before it shows up remain to be seen.

Numerous engineers of other companies are known to be working on the Spraberry problem. There are undoubtedly variations in their approach to the remedy. It is safe to assume however that all ideas or proposed methods are aimed at altering the equilibrium of the physical forces in the reservoir so that at low pressures the sand will be more permeable to oil flow than it is now.

The attitude of the engineers who are working most closely with the problem may be significant, or it may not be. But by and large, they seem rather calmly confident. The imbibition process is the only one which has been publicly disclosed. But there are rumors about the use of solvents, and that term could apply either to some rumors about injection of L.P.G. products or to chemical compounds.

Unitization Possible

Some reservoir engineers indicate that solution of the problem may require some unitization to get an area large enough to work with. There are hints that solutions have been developed which would require the initial use of expensive materials. However it is said that these materials could be recovered and used over and over, or salvaged and resold.

Suppose that one of these methods other than the imbibition process does work. What kind of results can be expected. The answers are rather startling. Some reputable engineers state quietly and confidently that they believe they can recover 50 per cent of the oil left in place in the sand after the well has gone dead.

That means that if the engineers' ideas work out, at least some of them expect to recover 2000 to 3000 additional barrels per acre from most of the wells that have already gone dead, or from wells that normally would go dead over the next year or so. For a 40-acre well, that means 80,000 to 120,000 extra barrels recovered, or at $2.50 per barrel, $200,000 to $300,000 additional gross revenue per well.

This may be wishful thinking by these engineers, at least at this stage when nothing has been proven in the field. On the other hand it may explain the calm confidence noticeable in the attitude of many of the reservoir engineers working on this problem. For if they can produce results of that magnitude from wells that otherwise are dead as far as oil is concerned, expensive methods and materials will be freely tried. If such results can be proven possible, but require unitization for their realization, it is safe to predict there will be few holdouts among operators whose wells have gone dead.

To most oil men, these recovery estimates seem over-optimistic. Even discounting professional enthusiams; even after recognizing that reservoir engineering is currently taking giant strides; they seem like pretty strong statements. But they have been made by reputable men, who do not usually go overboard. Oil men will certainly hope they are right, but probably keep their fingers crossed until field tests show what will actually happen.

Intangible Grounds

Up to now most of the tangible grounds for not giving way to despair on the Spraberry problem have been discussed. What are the powerful intangible grounds mentioned earlier? Very briefly, here they are.

The petroleum industry is run by aggressively progressive executives who have proved that an efficient industry can combine the profit motive with conservation of natural resources and its obligations to the public welfare.

Are these men going to walk off and leave a billion barrels of oil worth $2.5 billion, unrecovered in the ground, simply because past conventional producing methods won't work? The answer is obviously "No"; at least not until after a tremendous effort to solve the problem has failed completely.

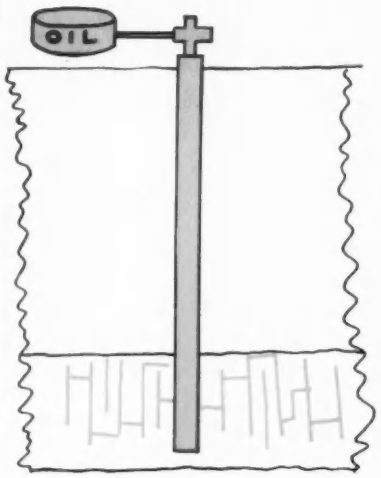
Reason for Optimism

The problem and its component parts are well understood and involve physical forces that obey natural laws. The industry has at its command thousands of exceptionally able scientists and technologists. Therefore, most intelligent men would reasonably assume that the Spraberry problem will be attacked vigorously and probably solved, just as many other serious problems of the industry in the past have been attacked and solved. So far as this author is concerned, this intangible ground is the soundest possible reason for maintaining a cautiously optimistic attitude toward the Spraberry problem.

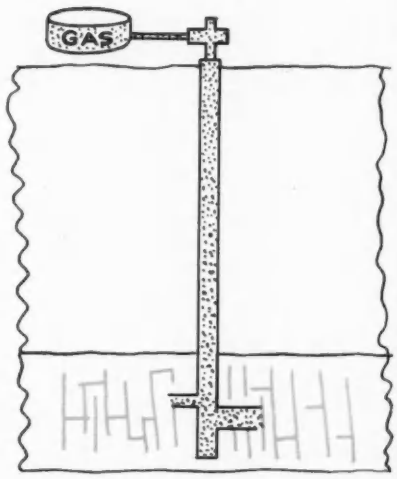
This is undoubtedly a monumental task for the reservoir engineers compared to any problem they have faced in the past. But with the support they will get from the industry executives, it is believed the engineers will meet the challenge successfully.

Spraberry Wells Die Young

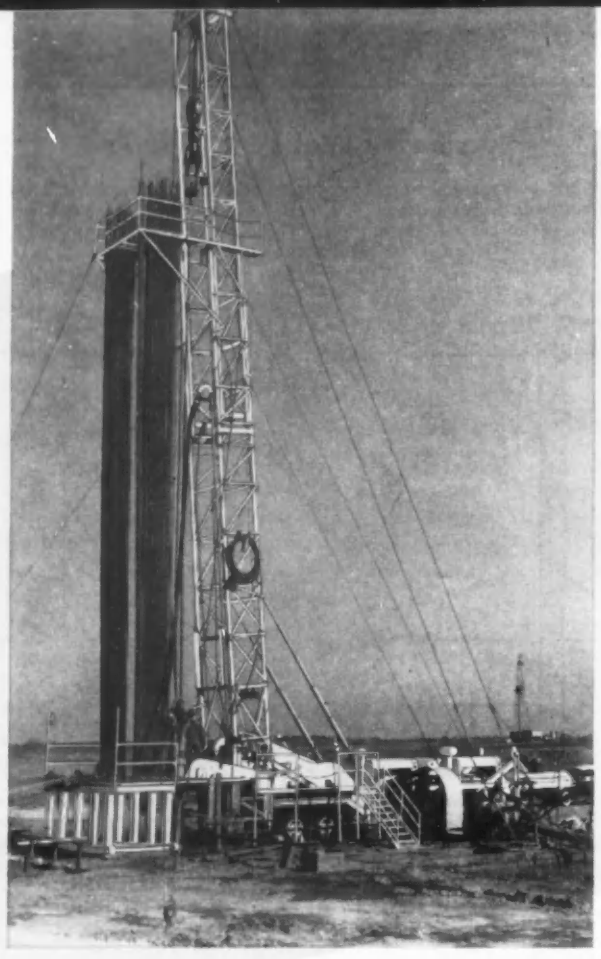
A Spraberry well can be expected to quit producing oil, though gas can still move out of the sand, when the reservoir pressure around the well drops below 1000 pounds per square inch. With 90 to 95 percent of the oil left in the sand, the oil man faces a great challenge to his ingenuity and will try hard to get it out.



While reservoir pressure remains above 1000 pounds per square inch, oil moves from fractures and adjacent sand into well and tank.



When reservoir pressure declines below 1000 p.s.i., gas comes out of solution in the oil, flows into well, and puts back-pressure on the oil, trapping or locking the oil in the formation.



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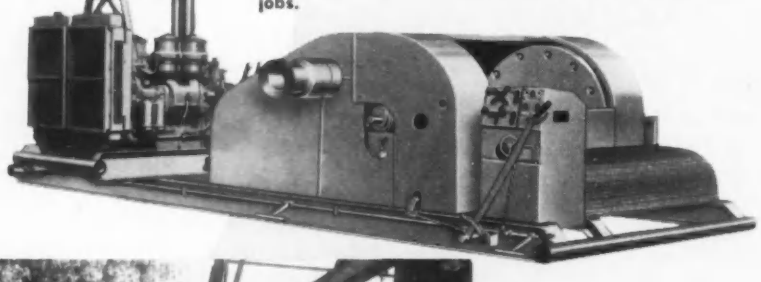
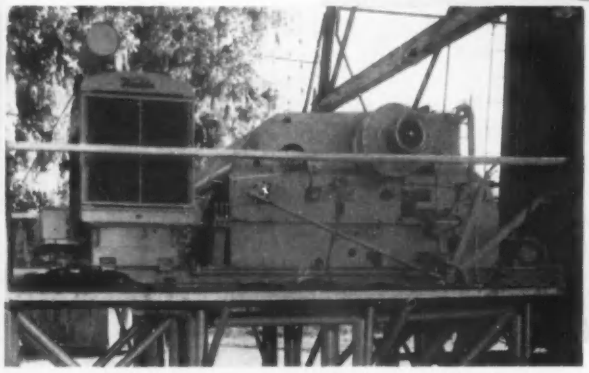
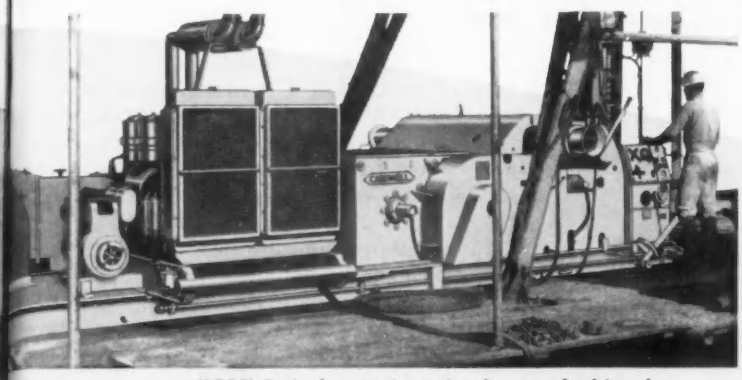


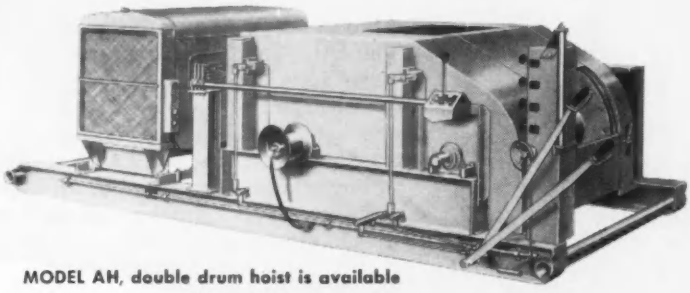


MODEL L, single engine, single or double drum draw works for 3,500-foot drilling or 7,000-foot workover jobs. Completely equipped with Cardwell air friction clutches for fast operation.

MODEL R, combination rig for rotary drilling to 4,500 feet or cable tool drilling to 7,500 feet. Shown with 65-foot, double-leg mast. Available in two smaller sizes: Models H and K.



MODEL D, single- or twin-engine draw works driven by Cardwell air friction clutches, including four-speed and reverse transmission. Recommended for 5,000-foot drilling and 10,000-foot workover jobs.



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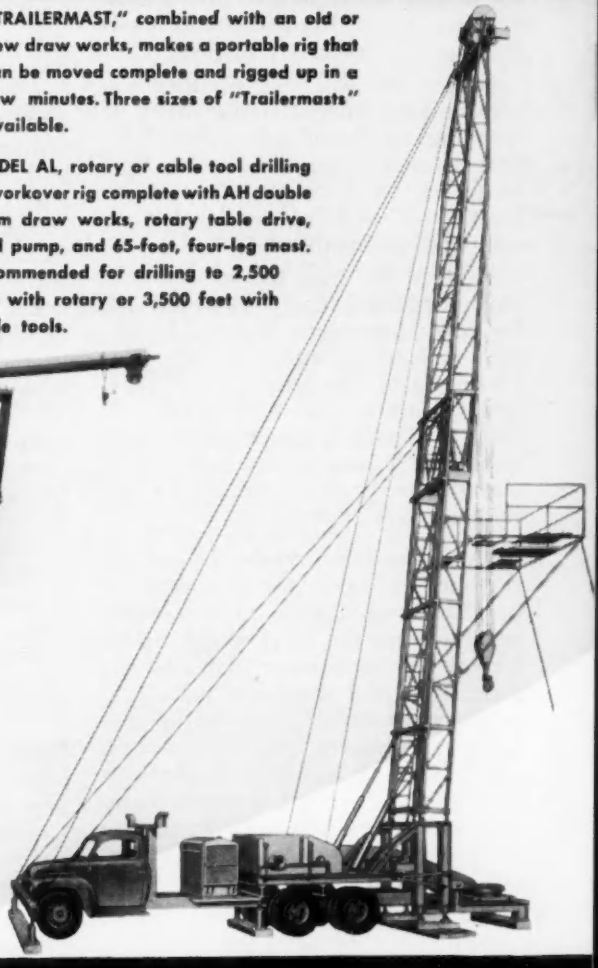
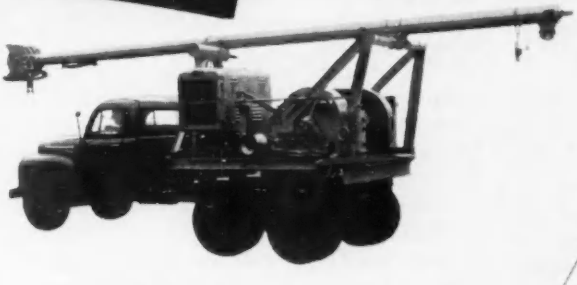
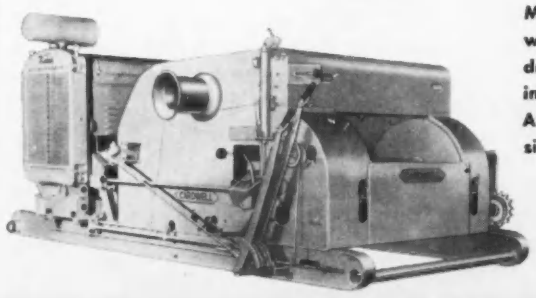


MODEL AH or MODEL AQ, single drum servicing hoist, for 5,000- and 3,000-foot servicing respectively. Equipped with Cardwell air-controlled friction clutches in the drum. Truck or skid mounting. Single- and double-leg masts are available.





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What's Behind Cartel Charges?

Action May Be Pre-Election Stunt

By DR. CORNELIUS H. ZONDAG

THE ANTI-TRUST action now being pushed by the government against five American and two foreign oil companies may be a typical pre-election stunt. The action certainly revives memories of the famous "Mother Hubbard" suit — later dropped—which was also filed on the eve of another important presidential election, when Roosevelt was challenging the two-term tradition.

Only time will tell whether the present Government action aims at breaking up the oil companies' integrated foreign operations in an effort to please some people abroad, or whether it is being used solely as campaign ammunition.

Political or not, this action will have dangerous repercussions abroad, far beyond anything Senator Sparkman may have anticipated when, as Chairman of the Senate Small Business Committee, he made public the Federal Trade Commission's report on the international petroleum cartel, over the strong objections of CIA and the State Department.

Action pleases Soviets. To pull the rug out from under the oil companies just now would seem to be playing squarely into the hand of the Soviet Union, for this is more than ever the time when the American petroleum industry needs the support of the U. S. government and of American public opinion. Nationalistic elements both here and abroad now find themselves vindicated by our Government's attempts to show that the oil companies have been guilty of violating even our own laws.

Although it is a simple matter to accuse the large oil companies of price fixing—the crux of the FTC report—it should be equally simple to see that for a highly standardized product like oil hardly any formal agreement is necessary to achieve fairly uniform price levels, since everybody tends to follow the industry's leader anyway. Why else is the price of cigarettes, steel, soft drinks or newspapers so generally uniform?

Foreign competition. Another basic fact to be remembered is that oil is not an American monopoly. Although our petroleum industry controls an impressive share of the world's oil reserves, it has encountered serious competition in the foreign field from both the British and Dutch companies and from Russia. How serious this competition could become was made clear in the 1920's when there was a scare that our oil reserves would become inadequate because Royal Dutch Shell—then rapidly expanding in the United States—was at the same time trying, with the support of the British and Dutch governments, to keep some foreign areas closed to American competition. This brought effective action by our government to support the American petroleum industry in its quest for foreign sources.

That's a far cry from the present time, when we find Washington invoking a Federal grand jury in order to begin anti-trust action against seven international oil firms.

Basic charges. The fundamental issue is simple. On the basis of a report prepared by the Federal Trade Commission in August 1951, the government charges that control over the international oil industry is largely in the hands of a few integrated companies who gradually achieved this position through local marketing cartels based on an agreement concluded in 1928, the so-called Achnacarry agreement, between Jersey Standard, Royal Dutch Shell, and the Anglo Iranian Oil Co. This arrangement, known as the "as is" agreement, provided, among others, for the acceptance by the companies concerned of their "present volume of business and their proportion of any future increase in consumption," the joint use of existing facilities, the shutting in of excess production, and the elimination of any competitive measures which would materially increase costs and prices to the consumer.

Although Jersey Standard dropped out of the agreement at an early date, the Federal Trade Commission claims that these principles were never abandoned and actually became the established practice in the industry. Thus the predominant position of seven international oil companies in the ownership of world petroleum resources, production, refining and transportation facilities was built through joint ownership in affiliated and subsidiary companies all over the world, crude oil sharing agreements in important producing areas, and the development of an agreed-upon philosophy of cooperation in marketing the industry's end products.

In addition, the government charges that as a result of this pattern of control the industry was able, under its complicated basing point system, to sell Middle East oil at $1.75 a barrel to MSA-ECA while charging other customers only $1.43. In other words, Middle East crude was sold as if it were actually produced in and hauled from the U. S., based on the higher Gulf Coast quotations, which allegedly involved a loss to the government of about $67 million.

Nothing new. The FTC report presents hardly anything new to the insider. It is an attractive looking book totalling 378 pages and is full of charts, tables and well known facts, from which rather predetermined conclusions are drawn.

The only new issue is whether the companies actually overcharged ECA-MSA, and this the courts will have to decide. Even this dates back to 1948 when the first Marshall Plan sales were started.

To make an orderly marketing possible, oil prices are generally based on Texas Gulf quotations since Texas, being the largest producer, naturally determines other prices. As the Middle East gradually developed and increased its output after the war, it was clear that this area would eventually set a base price of its own. For the time being, however, it looked like Europe would be dependent on oil

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from both the Middle East and the Caribbean areas.

Although no system of pricing is entirely satisfactory—the consumer always considers the price too high, the producer too low—to attack the basing price system in the oil industry is rather senseless for it widens rather than restricts the number of suppliers. Certainly a true monopolist would never want to resort to this pricing system. Anyway, prices must be high enough to encourage production, for if they are too low, the item gets in short supply. It is rather significant that with demand for petroleum products moving steadily upward, prices have been maintained at such a fair level.

Bigness bad. What the FTC report is really implying in its charges is that bigness is bad per se and must be destroyed. The report's introduction states in a most significant and arbitrary manner that "Today the power of international oil companies is so vast as to invite its abuse." In blasting all cartels, however, the report completely overlooks the realities of world trade. For the fact is that cartels outside the U. S. are frequently nothing but an adaptation to existing world conditions and have arisen mainly because of certain economic and geographic factors. One should never confuse cause and effect. This was even recognized long ago by the Webb-Pomerene Act which permitted a certain amount of cooperation by American business concerns without violating the anti-trust laws here.

In foreign operations cartels are a reality to be considered. If one does not like that reality the alternative is simply to stay out and leave the business to the foreigner. Yet think of the uproar if the American petroleum industry had followed this advice in the 1920's and Royal Dutch Shell and a few others, including Russia, were today the undisputed owners of the world's petroleum resources.

It is interesting to note that a recent report by the State Department on foreign legislation regarding monopoly practices comes to the conclusion that cartels are not viewed in most foreign countries with the same abhorrence as in the U. S. This is quite understandable when we realize that the Sherman Act deals with a rather unique situation, namely free competition in a tremendous area such as the U. S. Most countries are not in such a fortunate position as the U. S. In many small countries the Government tries desperately to protect domestic industry through tariffs and import duties. Foreigners may even prefer to buy the more expensive wares from those countries with whom they can trade in return, resulting in all sorts of restrictive practices. Cartels being private agreements are frequently only one aspect of such restrictive circumstances, which raises the question whether the American anti-trust concept should be extended beyond the U. S. border. Unofficial British circles have already raised the question of the jurisdiction of American Courts over completely foreign activities.

Disregards industry structure. The main mistake of the FTC report is that it fails to give sufficient weight to the basic structure of the petroleum industry, applying criteria as if it were dealing with a local dry cleaning chain. Both the type of product and the interdependence of petroleum producing and consuming countries make the industry essentially international, while the huge investments required make it big business. Yet the FTC report invariably interprets the fact that some companies joined hands abroad as a scheme to get control, although quite often such action was prompted by the fact that the investments required were so vast that not even the biggest company could risk them alone. While the report cites an example that Jersey Standard made $10 for every dollar invested in one particular venture, it fails to mention the many cases where similar investments resulted in a total loss.

The FTC report apparently finds it very hard to realize what everybody knows, namely, that petroleum production just has to be big business. When the report critically states that "the long period of the contracts, the great quantities of oil involved, the unusual nature of the pricing methods and the conditions of sale . . . suggest that these contracts extend far beyond the ordinary business transaction," it merely proves that the oil business is an unusual business. The type of simplicity desired by the FTC report is hardly possible in any complex operation. The cherished remedy of breaking the industry up into many small parts would only wreck it, since it has been sufficiently proven that the smaller companies lack the resources to go into the foreign field. By the FTC's reasoning ten plumbers might begrudge the local gas company its existence, yet they could never run the business themselves for lack of capital.

It is not surprising that our Defense Department is already highly concerned at the threat of divestment in the petroleum industry, which would not only endanger supplies but would eventually result in the loss of American reserves abroad, thus reviving the shortage scare of the 1920's.

Nor should it be forgotten that the basic agreements under attack were drawn up at a time of price war in many countries, particularly the Far East, in order to cope with the problem of Russian dumping tactics. Between the time of the companies' action and the final judgment by the Federal Trade Commission lies a period of twenty years of great international and social upheaval, including a major war, to which changes the industry had to adapt itself constantly. Studying the report one comes to realize once more the tremendous problems which the oil industry had to overcome in these years, problems so vast and complex that any possible decision could always be criticized on the basis of hindsight.

Control or chaos. In the international oil industry in particular there must be a highly integrated, well controlled system if the U. S. is to supply its power needs smoothly and effectively at fairly stable prices. Long-term contracts must be made and permanent sources of supply must be secured to justify the large investments in refineries costing millions of dollars. The alternative is an unstable, anarchic situation involving the reckless waste of a basic resource with occasional breakdowns of supplies and a tremendous decrease in overall productivity. While such a system would not be impossible, it would seem like a high price to pay to satisfy a purely legalistic concept.

It is unfortunate that in our day and age the question of saint or sinner in big business depends so much on a narrow legal interpretation rather than on the economic result. No matter how many economic benefits a firm may produce to the consumer—just think of the A & P as a case in point—it is all of no use if a legal technicality pops up which throws an industry open to attack.

It is true that a few small outfits might occasionally be able to undersell the big concerns, yet it is also true that such operations, usually on the fringe of large municipal markets, are generally in the nature of fly-by-night stunts with the full burden of the normal supply falling on the large concerns. It is very significant that to insure an adequate supply of oil the government on more than one occasion forced the companies to cooperate very closely. For example, about two years ago it set up the Foreign

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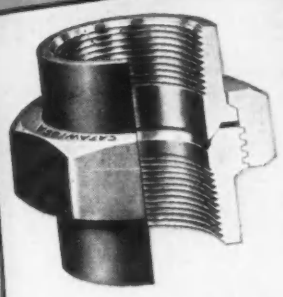

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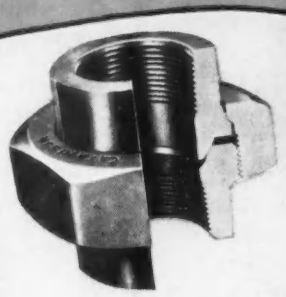

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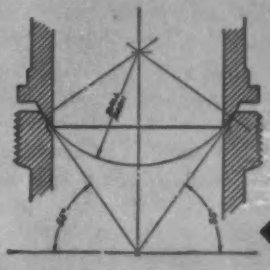

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UNITED STATES STEEL

Supply Committee to cope with the loss of 700,000 barrels a day from Iran, which sometimes jokingly has been called a perfect cartel. Certainly the government did not run to the small firms for help in this emergency situation.

Government control abroad. In many foreign countries petroleum operations are to a large extent subject to government control. Foreign governments not only interfere frequently in the marketing of petroleum products in their territories, they often even try to establish exclusive rights for their own nationals. Although an exclusive concession may be had in the eyes of the Department of Justice, the British government went out of its way to get its nationals some of these plums. Thus the American petroleum industry finds itself not only subject to government pressure abroad, but also to pressure from foreign competitors who are not hampered by the U. S. anti-trust laws.

It is most interesting that many of the agreements now under attack by the FTC were concluded with U. S. government approval. The State Department itself has been a party to about everything the American oil companies have been doing abroad for many years. It went out of its way to help the American companies obtain concessions in Indonesia in the 1920's; it backed them fully in their efforts to get into Iracq and Kuwait.

The report shows clearly that complex negotiations involving other nations, rival companies and foreign potentates often lasted for years before a solution satisfactory to all could be reached. While it frequently concludes that such agreements were drawn up only to exclude "outsiders," its own research shows that time and again the alleged "schemes" either backfired because of continually changing market conditions or that the "evil schemers" were no match for the competition who managed to get either in or around these deals anyway, as the history of the Red Line agreement and of the Arabian American Oil Company shows all too clearly.

Planning vs. waste. The FTC report's attack on the interstate oil compact, established by law to prevent the waste of a vital resource such as petroleum, stems from an old American desire to have one's cake and eat it too. In order to prevent waste, conservation practices were put into effect regulating the flow of oil in this country to prevent a senseless rush to unnecessary and uneconomical drilling which would only increase production costs. However, once you start controlling the flow of oil because it is a vital resource which should not be wasted, you also tend to stabilize its price which is exactly what the report complains about.

Yet if John L. Lewis suggests that the miners work only a few days a week to reduce an oversupply of coal, he tries to do exactly the same thing; namely, to spread the work in order to get a stabilized work program which would help in keeping some marginal mines open, thus making the best use of available resources. No anti-trust for Lewis, though.

It is ironic that in its introduction the report is most concerned about the question whether or not the structure of international oil prices has imposed an excessive burden on friendly nations and thus indirectly on the American public which is extending economic and military assistance to these nations, while at the same time asking whether the dumping of foreign oil in the U. S. has hurt the independent American producers. Despite the Federal Trade Commission's concern about the American consumer, there is no doubt that if the large concerns could sell foreign oil to the American public at a fraction of the U. S. cost, the FTC would immediately suggest that the tariff be raised, or to use its favorite term, resort be made to "restrictive practices" to protect American industry.

Our changing panorama. The Sherman Act presupposes that modern big business is still based on competition alone, a concept which is largely a dream although it appeals to the average American. True, in the system prevalent at the time of the Act when most of the people were either farmers or small independents there were many unfair practices against which the public, then largely poor, had to be protected. However, the question is whether we would want the 1890 type competition in today's America, which has changed so much from a nation of small independents to a nation of employees. For it is certain that old-time competition can easily contribute to severe depressions.

Let us not lose sight of historical development. First, there was price competition, often severe. Then gradually some firms got an advantage because they eliminated their competitors. In the next stage a few firms which successfully survived together held the advantage through an oligopoly position which forced them to be more and more progressive, build laboratories, develop new products—all of which makes it harder and harder for newcomers to break in. Even our tax laws encourage this, for the excess profit tax certainly gives the Johnny-come-lately in any field a much tougher time.

The fact, however, that old-time price competition frequently vanishes from today's market does not mean that the big firms go completely unchecked; they just do not get checked in the way the Sherman law foresaw it. Today it is frequently the powerful buyer such as the Swedish cooperative, the big department store, the large food chain and the government procurement agencies which keep the big firms in line. The role of the unions may likewise be mentioned in this connection, for it is significant that the most powerful unions are today found in those industries which were guilty of the greatest exploitation.

Modern competition lies much more in good public relations, in advertising and in generally being progressive. A murderous price competition hardly ever leads to progress. For example, it is interesting to see

About the Author

DR. C. H. ZONDAG, who holds advanced degrees in international laws, economics and psychology from leading universities in the U. S. and abroad, has had a varied career both in diplomatic work and in the oil business. Having been associated with two major American oil companies in the foreign field, he has long been a student of international affairs and foreign petroleum legislation. He has published a book and many articles on international relations, petroleum and economic subjects dealing with Latin America.

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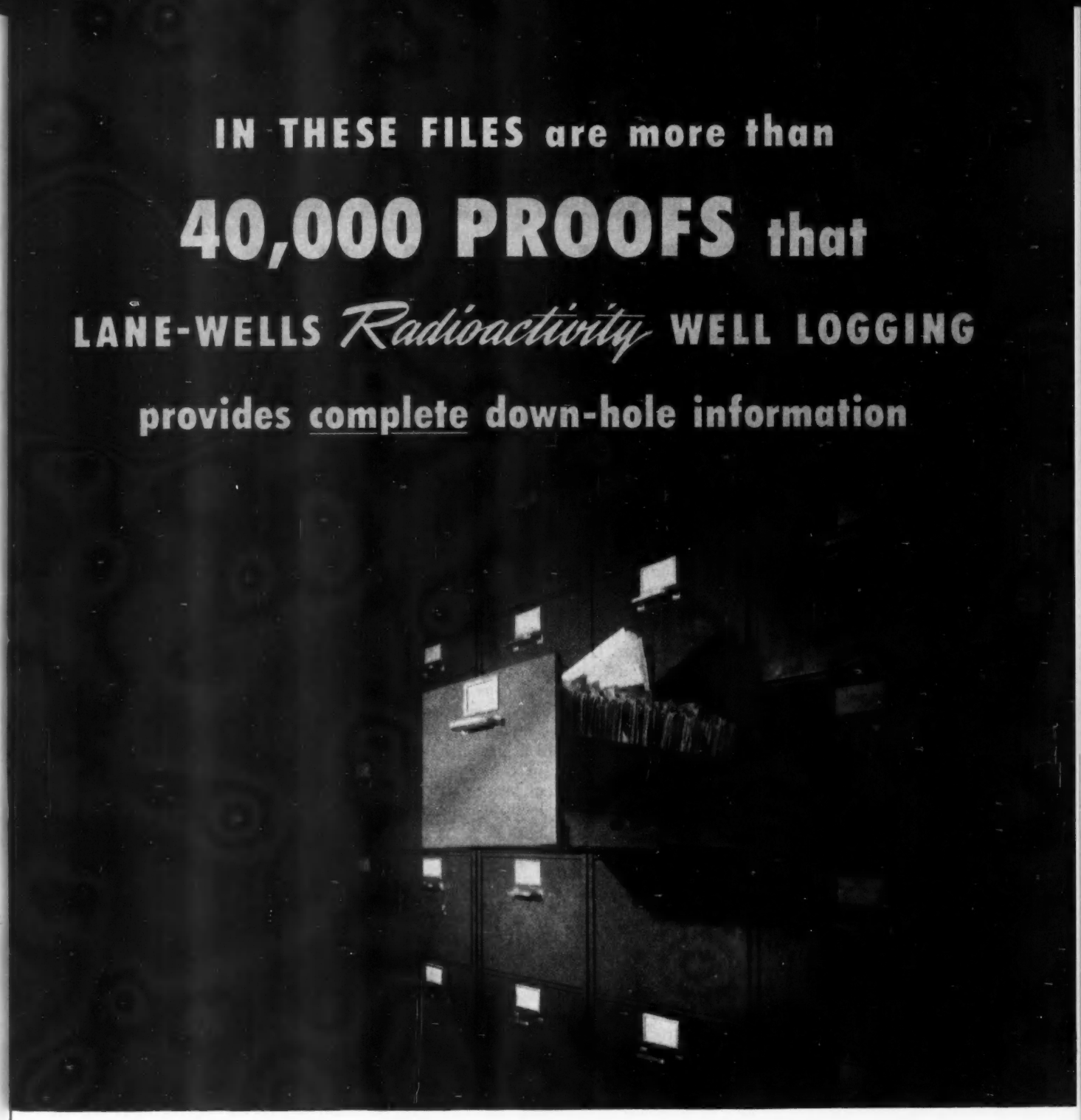

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that the coal industry which is admittedly highly competitive and consists of many small units, is losing every day to oil where outstanding progress has been made as a result of the indutry's coordinated development programs. It hardly needs any comment that it is a lot simpler to draw up a research plan for a few large firms than for many small ones.

There are no perfectly competitive markets. A proper blend of competitive and monopolistic elements is needed in any market to produce workable competition. Modern big business is frequently rendering a tremendous service through its research and promotion. It is no wonder that the average American looks with pride to such firms as General Electric and DuPont, whose nylon is on everybody's lips, while he is hardly ever impressed with the efforts of the local appliance manufacturer in Middletown who does a most courageous and creditable job in trying to keep up with the giants. Yet the latter will always be the first love of the anti-trust division of the Department of Justice.

End confusion. While we curse our own big business, we tell Europe at the same time that their small units are uneconomical and that they should join hands to achieve a more efficient production. While MSA invites European businessmen for a six-week indoctrination course in modern productive methods, a glance at any of the newspapers will teach those visitors that we apparently disapprove of the system under which these methods were developed, let alone what to think of all those oil agreements which the State Department approved and the Justice Department wants to tear up.

It is this confusion of ideas emanating from the various government agencies which is so undignified and should be stopped. Fortunately, we live in a nation where the American consumer is still the one who ultimately makes the laws. In spite of all the present fanfare, the FTC will have a hard time to convince the American consumer that he has been exploited by the American petroleum industry, particularly when the record shows that the industry constantly has passed on to him the benefits of its research in the form of better and cheaper products.

Fuels From Shale May Soon Be Economically Feasible

THE ECONOMIC FEASIBILITY of producing liquid fuels from oil shale is not too far away—if the government will keep its hands off.

Source for this statement is Reese H. Taylor, president of The Union Oil Company of California, speaking recently before the Texas Mid-Continent Oil & Gas Association at Fort Worth.

Taylor described the process by which his company is extracting oil from Colorado shale as being ". . . just about as close to commercial perpetual motion as anything in recent years," and showed how the cost of producing finished gasoline by the method could be reduced to 14.7 cents per gallon at Los Angeles. The present equivalent price of gasoline at Los Angeles is approximately 12 cents.

NPC Study

These figures were arrived at by a Committee on Synthetic Liquid Fuels Production Costs set up by the National Petroleum Council last year at the request of Secretary of the Interior Chapman. For purposes of the study, the committee took finished products at Los Angeles as a base for the comparison. The figures would apply equally to finished products at Chicago or St. Louis, for in both instances, the pipe line haul from western Colorado would be about the same. Los Angeles was chosen because the demand for petroleum products there, in relation to the rate of development of new petroleum reserves, has increased so rapidly.

Taylor said the study showed first that the shale oil should be partially refinished at a central refinery near the mines. And second, that this refinery, to be economically efficient, should consist of at least two units, each with raw shale capacity of 25,000 barrels per calendar day—or 50,000 barrels in all.

To keep 50,000 barrels per calendar day of shale oil feeding into the refinery units, four base mining and retorting units would be required—each capable of mining and retorting 20,000 tons of oil shale daily.

Taylor said these plants and mines would cost an estimated $305 million. Another $27 million would be needed to house employes in the area. That would make a total of $332 million for a complete setup capable of mining and processing 50,000 barrels of raw shale oil daily.

When all the costs of operating such a plant are added up, including a 6 percent return after taxes on the capital investment, plus pipe lines charges, a gallon of gasoline produced by this process would cost 16.2 cents at Los Angeles.

By building five plants of this basic unit size in the area, and thereby increasing the efficiency of pipe line shipments, the cost of the finished gasoline could be reduced to 14.7 cents per gallon. But, said Taylor, this would require a capital investment of $1½ billion.

Cautioning Factors

Warning against a long leap to an extravagant conclusion, Taylor pointed out that (1) there is no provision in these figures for the cost of raw shale before it is mined, and there won't be any such figure until the production of shale oil becomes commercially feasible; (2) the investment per-barrel-a-day of processing capacity for an oil shale operation is $8400, which is high compared with petroleum production; and (3) a 6 percent return after taxes on an investment of this kind is too low, perhaps 9 percent too low, because of the risk of obsolescence.

Whatever the future of shale oil, said Taylor, it must be developed by private industry. "In every instance, a nation's progress in the development of its petroleum resources has been in direct ratio to the degree to which private industry has been allowed to develop those resources."

Need for Safety Programs Spotlighted

Upturn is recorded in accident frequency rate after continuing drop since 1945; production branch records only downturn.

THE safety record of the petroleum industry has shown an overall improvement in the postwar years after rapidly mounting to near-peak levels in 1945. But 1951 saw an upturn in the number of accidents from the industry's best year in 1950. In view of the sharp increase in operations during the past seven years, the downturn in frequency rates of total injuries is indicative of the value of accident prevention training in the industry.

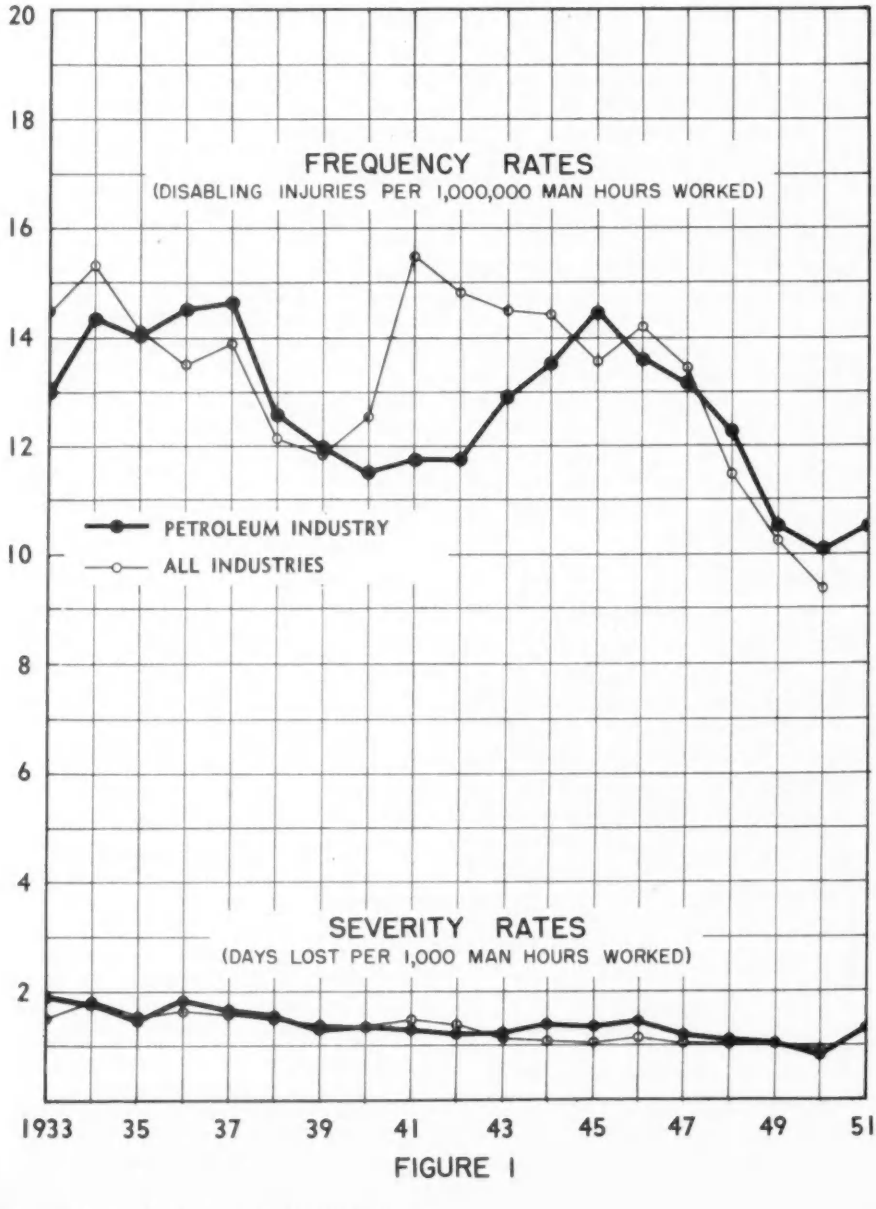


FIGURE 1

Total injuries—temporary, permanent and fatal—in the petroleum industry after generally running below the rate for all industries since prewar 1940, in recent years have moved higher than the record of industry as a group (see Figure 1) indicating a strong need for a continuation and expansion of oil company safety programs.

Study Made by API

The annual summary of injuries in the petroleum industry, a study compiled by the American Petroleum Institute based on the collective experience of nearly 300 companies and subsidiaries employing 481,926 persons with a total exposure of 1,033,663,000 hours, showed that in 1951 the industry had a disabling injury frequency rate of 10.50 per million man-hours worked and a severity rate of 1.29 days lost per 1,000 man-hours worked. The best safety record in the industry's history as far as records go back was set in 1950 when the frequency rate dropped to 10.08 per million man-hours worked and the severity rate dropped below one day for the first time with an average of 0.84.

An analysis of 1951 reports of injuries showed that the ratio of days lost to injuries, including fatalities, averaged 123 days per injury, compared with a 1950 average of 84. Excluding fatalities, the 1951 aver-

age was 39 days per injury, compared with 36 in 1950.

Drilling operations have shown the highest frequency of disabling injuries of the major industry branches, though its safety performance in the postwar years has recorded the greatest improvement. As shown in Figure 2, the frequency rate of injuries in drilling operations dropped sharply from 74.73 in 1945 to 41.00 in 1951, and the severity rate was cut in half, from 9.51 in 1945 to 4.60 in 1951. This improvement is much greater than indicated when considering total well completions in 1951 (45,584) jumped 68 percent over the number completed in 1945, while the number of employes involved in drilling operations included in the API survey rose only from 7428 in 1945 to 8535 in 1951.

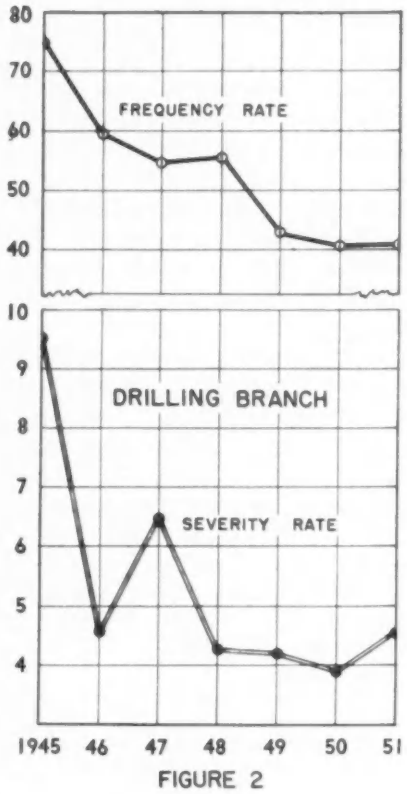


FIGURE 2

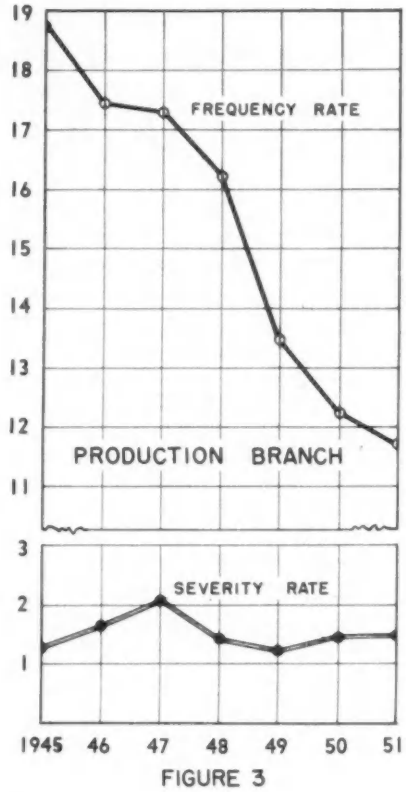


FIGURE 3

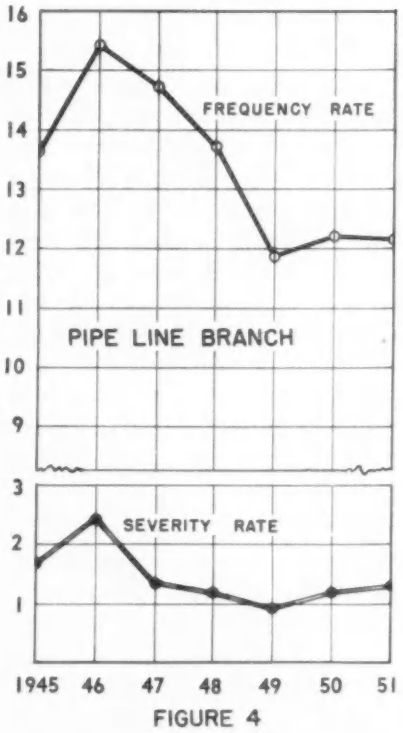


FIGURE 4

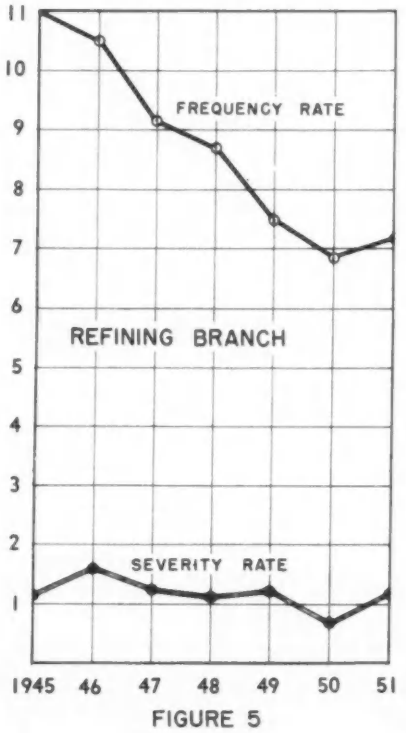


FIGURE 5

Frequency Downturn

The production branch was the only major division of the industry to record a downturn in the frequency of injuries in 1951, dropping to a rate of 11.70 per million man-hours worked from 12.22 in 1950. The severity rate showed a slight increase from 1.45 days lost per 1000 hours worked in 1950 to 1.46 in 1951. As indicated in Figure 3, the production branch has had a noticeable gain in safety performance in the postwar period, with the frequency rate declining from 18.68 in 1945 to 11.70 in 1951. The severity rate in production operations has shown an increase from 1.28 in 1945 to 1.46 in 1951. During this period, production of crude oil has increased one-third to an average of 6,149,100 barrels daily in 1951 while the number of workers included in the safety survey in production operations has increased 29 percent to 66,281.

The safety record in the pipe line branch (Figure 4) has had a two-year steady upturn in frequency of disabling injuries since the low of 11.84 per million hours worked in 1949. The rate of increase in accident in pipe line operations has been much sharper in 1950 and 1951 than other major divisions of the industry setting a rate of 12.92 last year, compared with 13.61 in 1945 and the postwar peak of 15.51 in 1946. The severity of injuries in the pipe line branch, however, has been relatively low, considering frequency. The 1951 rate of days lost per 1000 man hours worked due to injuries amounted to 1.29, up slightly from 1.16 in 1950.

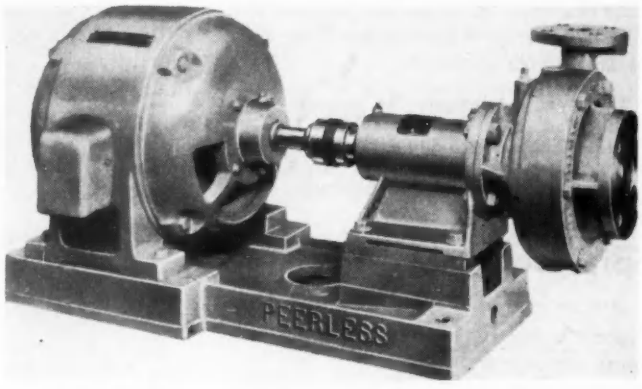
Refinery Statistics

After a steady improvement in frequency of injuries since 1945, the refining branch had an increase in the number of injuries in 1951 from the postwar low in 1950, rising to a frequency rate of 7.49 per million man-hours worked from 6.86 in 1950 (Figure 5). The severity rate among refinery workers, however, jumped sharply in 1951 to a rate of 1.15 days lost per 1000 man-hours worked, nearly double 1950's rate of 0.60. The refinery branch, however, continues to show the best safety performance of the major industry divisions.

New Equipment

Supplementing Composite Catalog

Chemical Transfer Pump



Characterized by the use of a mechanical shaft seal in place of the usual stuffing box, and by use of a stainless steel alloy for the wetted end, this CTB pump made by Peerless Pump Division of Food Machinery and Chemical Corporation is designed for continuous or intermittent duty. The model includes horizontal end-suction, top discharge design, with a vertically split case. Built in four sizes, the capacities range from 10 to 250 gpm. Another new design feature is the use of a semi-open type impeller, with repelling vanes cast on the back of the impeller shroud. The repelling vanes assure greater capability for performing maximum slurry and abrasive work.

This item supplements Peerless Pump Division, Food Machinery and Chemical Corporation data on page 4165 of Composite Catalog, 18th Edition.

Circle No. 13 on Postcard

Tubing Stripper

A universal type tubing stripper which represents an innovation in well maintenance and workover pressure control equipment has been announced by Petroleum Mechanical Development Company. The "Flex Strip" stripper rubbers are adapted to engage and seal against any make of tubing head, blowout preventer, or wellhead fitting having a bore of from 6⅜ to 7¼ inches, and are made in 2- and 2½-inch and a combination size. The rubber is held in place by a steel adapter made to engage any 6 (7)-inch API flange, series 4, 6, 9, or 1500 which has either an R-45 or R-46 groove. The adapter assembly is held down on the existing flange by screwing four of the flange stud bolts into threaded holes in the adapter.

This item supplements Petroleum Mechanical Development Company data on page 4228 of Composite Catalog, 18th Edition.

Circle No. 14 on Postcard

Truck Crane

The new Miti-Mite truck crane offered by Harnischfeger Corporation is exclusively for truck service and is not an adaptation of a crawler excavator. The crane is readily convertible for any front end service—shovel, trench hoe, dragline, clamshell, crane and magnet crane. It has a ⅜ cubic yard capacity as shovel and 7-ton capacity as crane. The crane's power box contains all driving machinery, including shafts, drums, gantry, engine, counterweight and front end attachments. A six-cylinder gasoline engine provides power, driving

through a heavy-duty four-speed transmission. Second speed is normal digging speed. All machinery is fully enclosed, running in oil.

This item supplements Harnischfeger Corporation data on pages 2222-2224 of Composite Catalog, 18th Edition.

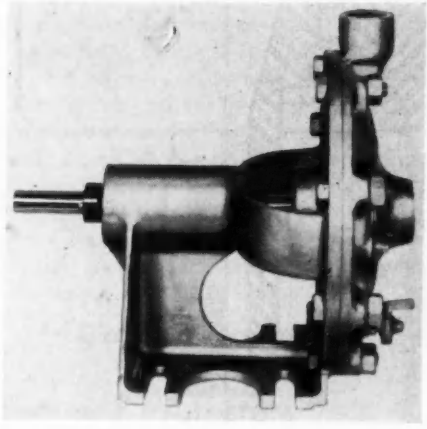
Circle No. 15 on Postcard

Aluminum Bus Bars

Aluminum bus bars are now used in the Flex-A-Power feeder or plug-in electrical distribution systems made by the Trumbull Electric Department of the General Electric Company. Copper models weigh from 30 to 70 percent greater than those using the new aluminum bus bars. Sections of Flex-A-Power which normally required a motor crane to hoist are now sufficiently portable to be handled without mechanical assistance.

This item supplements General Electric Company data on pages 1901-1920 of Composite Catalog, 18th Edition.

Circle No. 16 on Postcard



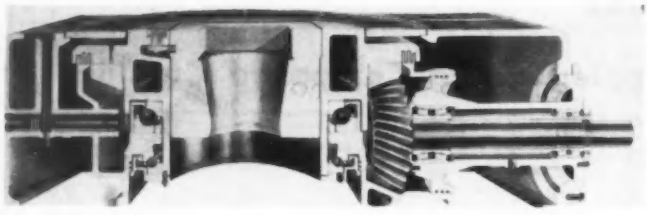
Reversible Pump

A new centrifugal pump which operates when rotated in either direction has been announced by Gardner-Denver Company. The model CAY is designed primarily for circulating cooling water in air compressors, diesel and gasoline engines, and other water-cooled machines. The manufacturer says this model can be installed on either side of the same machine without turning the pump around when moving it from one side to the other. Model CAY is suitable for heads up to 50 feet and capacities up to 67 gallons per minute.

This item supplements Gardner-Denver Company data on pages 1808-1815 of Composite Catalog, 18th Edition.

Circle No. 17 on Postcard

Rotary Series



An improved model of the Brewster Company Inc., RSH rotary series is currently available. The cast steel bed has been redesigned with a flush deck for greater safety, and heavier internal walls for increased load bearing capacity have been incorporated in the newest model. Mud seals are a triple groove lubricated labyrinth which keep drilling mud out of the gear compartment. Ball type holddown bearings help keep table in alignment under heavy loads. The gears are oil bath lubricated and the bearings are grease lubricated. The rotary is manufactured in sizes of 18 and 22 inches.

This item supplements the Brewster Company, Inc., data on pages 841-876 of Composite Catalog, 18th Edition.

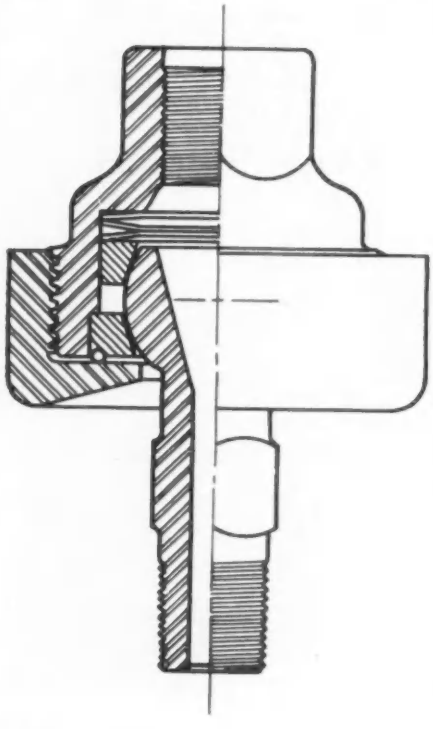
Circle No. 19 on Postcard

Moly-Manganese Electrodes

Production of a moly-manganese material for manual welding and in coils for automatic electric application has been announced by Stoody Company. Physical properties of bare Stoody moly-manganese as deposited are as follows: Rockwell hardness 85-90 B, and as cold worked, 43-47 C; tensile strength, 100,000 psi; yield strength, 85,000 psi.; elongation in 2 inches, 14 percent; deposits non-magnetic. This electrode is designed primarily as a build-up material for manganese steel parts. Deposits of the bare rod possess maximum physical properties and have weldability closely approaching the conventional coated electrodes.

This item supplements Stoody Company data on pages 4766-4768 of Composite Catalog, 18th Edition.

Circle No. 22 on Postcard



Fireproof Ball Joints

Fireproof, all steel, flexible ball joints suitable for use on working pressures up to 7500 psi. (hydraulic) are offered by Barco Manufacturing Company. Produced in steel and alloy steel, the design differs somewhat from lower pressure jointr in that the inner seal is a free-floating part carried under constant spring pressure. Steel construction and metal seals provide fire protection. Because of its rugged construction the manufacturer recommends this type joint for use in the petroleum producing field

This item supplements Barco Manuacturing Company data on page 463 of Composite Catalog, 18th Edition.

Circle No. 18 on Postcard

Spray Jet

Spray jets in the self-cleaning filter system made by Hercules Filter Company are now a part of a removable strainer assembly which is inserted from the outside of the header and passes through it. When a spray jet becomes clogged it is merely necessary to unscrew the assembly from the outside of the tank, clean the nozzle and replace.

This item supplements Hercules Filter Corporation data on page 2245 of Composite Catalog, 18th Edition.

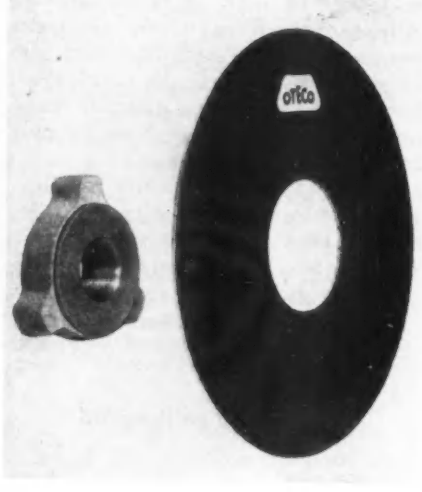
Circle No. 20 on Postcard

Constant Flow Valve

A new constant flow valve which puts an end to the problem of clogged orifices and the limiting factor of fixed orifices has been introduced by Camco, Inc. The CMC gas lift valve is freed of foreign matter by an increase of gas pressure above normal operating pressure which draws the stem out of the seat. When the pressure is reduced the stem returns to normal operating position with a clean orifice. This model incorporates a special tungsten carbide tip and seat. The larger taper of the stem is the seating surface against the seat. The lower shank of the stem remains inside the seat in normal operation.

This item supplements Camco, Inc., data on pages 1045-1064 of Composite Catalog, 18th Edition.

Circle No. 21 on Postcard



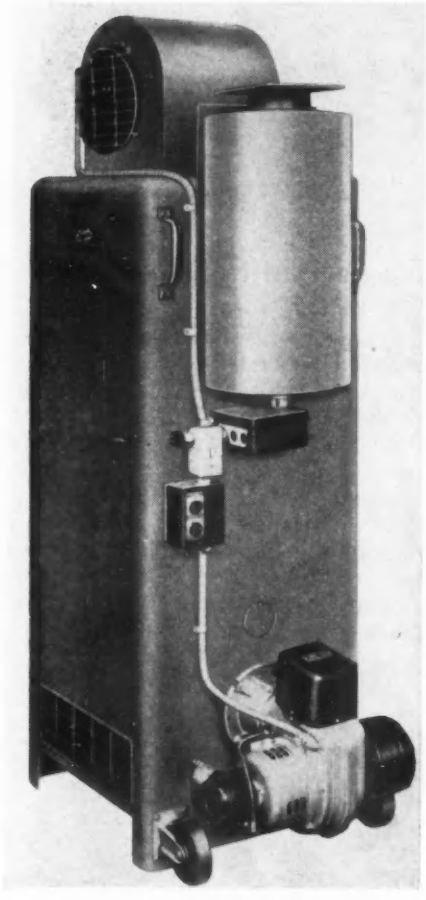
Splash Plate

A new type of splash plate for protection of extension rods and crossheads in slush pumps has been introduced by Oteco Equipment Company. As the piston rod of the slush pump slides in and out of the cylinder liner, mud and abrasive substances may leak from the cylinder. If such injurious substances reach the extension rod, damage to vital power parts can result. Protection is achieved by use of a disc-like splash plate on the Oteco Piston Rod Hammer-Up Lock-Nut, which is the lock nut connecting the piston rod to the crosshead. The splash plate is a disc of thick, tough plastic material, made for all sizes of oil field slush pumps.

This item supplements Oteco Equipment Company data on pages 4005-4006 of Composite Catalog, 18th Edition.

Circle No. 23 on Postcard

Other New Equipment



Adjustable Vent Heater

Newest addition to the Fageol Heat Machine Company line is a unit with 168,000 Btu and an adjustable vent for permanent installation or portable on-the-job use. Model VO-168 operates on the Fageol counter-flow principle of spraying heated air out across floor areas to form a six-foot-high blanket of warmth in the work zone. When used with a flue and vented outside, it is recommended for permanent use in confined areas such as small plants. Heat output vented is 130,000 Btu per hour.

Circle No. 24 on Postcard

Pressure Valves

Regulating single-seated and three-way valves operating against high upstream pressure are now available from the Industrial Division of Minneapolis-Honeywell Regulator Company.

Circle No. 25 on Postcard

Porcelain Enamel Finishes

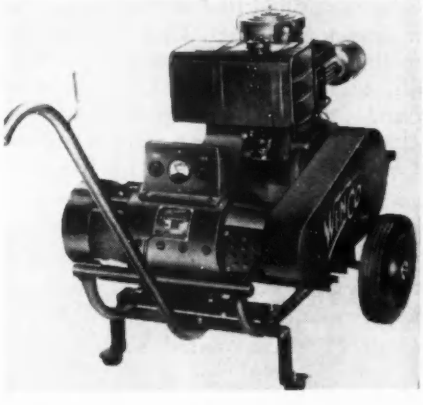
Acid resisting porcelain enamels for use in pipe line identification in the field is now available from Porcelain Enamel Finishers. The new enamels were made to resist atmospheric weathering and are especially adaptable for use as identification markers on pipe lines to simplify location of leaks and other service breakdowns from the air.

Circle No. 26 on Postcard

Instrument Lighting

Improved fluorescent lighting is made available as a standard option for various types of industrial instruments and control room panel boards made by Minneapolis-Honeywell Regulator Company. Fluorescent lighting is available now for electronic and rectangular case instruments and for control room panels.

Circle No. 27 on Postcard



Portable Engine-Generator

A new portable model engine-generator model 4500 has been added to the line made by Wincharger Corporation. Model 4500 is designed for full output at 115 volts, 60 cycles, alternating current. It has motor starting capacity of 4500 watts. Klixon thermostatic cut-out switches with manual reset protect the generator from overload and overheating. The cast iron outlet box located on top of the generator provides a voltmeter, and one 20 ampere capacity and two 15 ampere capacity twist-lock type outlets wired in parallel.

Circle No. 28 on Postcard

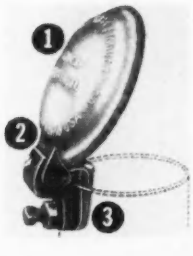
Well Checking Unit

The horizontal, portable checking unit by Oil Metering and Processing Equipment Corporation has a degassing and defoaming element placed on the inlet nozzel just inside the separator so that all of the well fluid must flow through it. The unit has a 1 x 15-inch elliptical manway in the outlet end of the vessel near the bottom so that drilling mud and sand can be cleaned out. There is a Kimray floatless oil dump valve. Optional equipment includes a free water knockout, any size or type oil and water meters, and any kind and size of orifice flange or fitting.

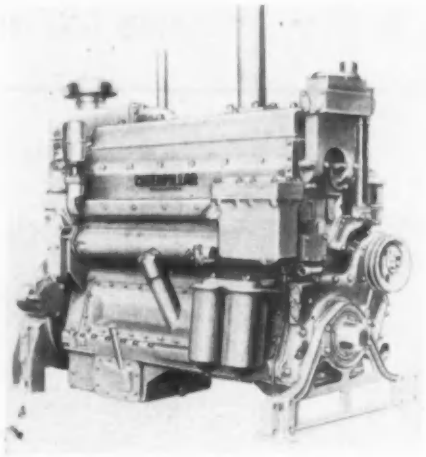
Circle No. 29 on Postcard

Exhaust Protectors

The "Cancap," redesigned by the manufacturer, Canton Cast Products Company, is now a lightweight cast aluminum alloy fused around the top of a malleable tear-shaped hinge which affords the extra lightness to open with the first puff of exhaust, and gives the hinge itself great strength for long wear. A wider opening action is gained by using a cadmium plated set screw with shakeproof washer as the pin of the hinge. The malleable mounting bracket simply slips over the pipe and is held by the cadmium plated set screw.



Circle No. 30 on Postcard



High Speed Diesel

A new high speed diesel engine is being produced by Caterpillar Tractor Company for industrial, electric set and marine arrangements. The basic D326 is six-cylinder and has a 5⅛-inch bore and a 6-inch stroke. The pumps are mounted directly adjacent to the cylinders they serve, and the fuel lines made short and identical. The pumps, intake and exhaust valves, are actuated by a single camshaft. Special heat resisting metal inserts in the tops of pistons and valve seats are features of these engines. Main and connecting rod bearings are precision-type of steel backed aluminum with high fatigue resistance. Piston cooling is by means of oil jets from under-mounted nozzles.

Circle No. 31 on Postcard

Fire Extinguisher

A new one- and two-quart Vaporizing Liquid fire extinguisher, Pressurized Model B, has been announced by The Fyr-Fyter Company. The extinguisher can be operated with one hand to release a 30-foot stream. The vaporizing liquid is completely discharged in 17 to 25 seconds by the positive force of odorless, non-toxic, moisture-free, pressurized nitrogen. The extinguisher is made of brass, and, to simplify inspection, cleaning and recharging, the entire valve assembly and pick-up tube unscrew as a unit from the shell.

Circle No. 32 on Postcard

Plasticized Aluminum

A new industrial aluminum coating that can be sprayed without spattering, has been placed on the market by Royston Laboratories, Inc. Special vehicle and solvents in Roylac aluminum cause it to dry into a cottony, non-adhering powder in four feet of travel. Roylac incorporates a tightly bonded corrosion-resistant film with a bright aluminum finish, and is particularly effective against acid-type fumes and salt or moist air. The material is plasticized to provide a film of good flexibility and bonding tack, effective for sealing wood or other porous surfaces; the non-reactive vehicle makes the coating excellent for use on galvanized objects and other basic metals.

Circle No. 33 on Postcard

Base Station Model

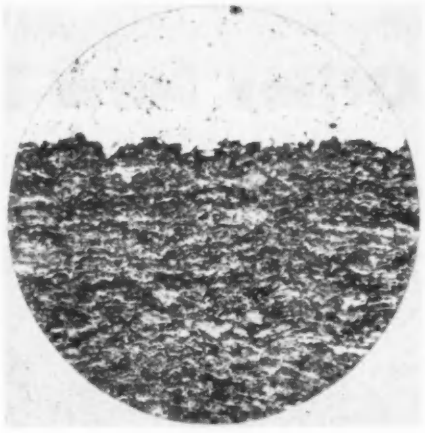
Motorola Inc. has developed a locally controlled base station housed in a desk top cabinet. Designed for use in the 450 to 460 mc. range as well as 460 to 470 mc. range (Citizen's radio band), the set can be operated without channel crowding encountered on lower frequency bands. This band enjoys restricted use. Features include the Sensicon receiver design with its triple I.F. conversion and Permakay filter which guarantees permanent selectivity under all weather conditions. High Q, silver plated, sealed tuned cavities provide an RF signal preselection, and the receiver also incorporates automatic frequency control.

Circle No. 34 on Postcard

Graphite Ground Anode

Graphite ground anodes for use in corrosion protection service are now being manufactured by Great Lakes Carbon Corporation for distribution through Cathodic Protection Service. The CPS line of graphite anodes features a strong lead which is secured to the anode by a new method which permits exceptionally heavy loads on the lead itself.

Circle No. 35 on Postcard



Flame Plating

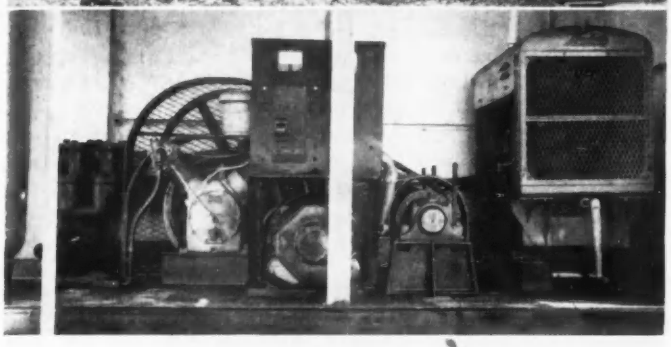
Linde Air Products Company has developed a new method of applying powdered metals—like tungsten carbide—to metal parts, with thickness of the deposit ranging from 0.0005 to 0.020 inch. Advantages of the new process are: the temperature of the base metal does not exceed 400° F. during the application; the coating is ductile and resists spalling and chipping; ball bearings, and high speed shafts show exceptional wear resistance when coated.

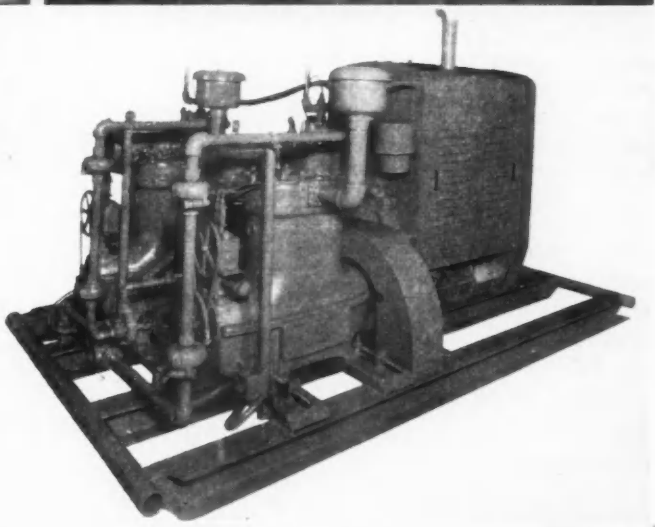
Circle No. 36 on Postcard

Plastic Fittings

Yardley Plastics Company is making Tenite plastic pipe and fittings for oil field pipe lines. The fittings are injection molded in a variety of sizes and shapes, either slip-sleeve or threaded, to fit extruded pipe with diameters up to six inches. Slip-sleeve couplings can be quickly bonded into Tenite lines by means of a cement and thinner.

Circle No. 37 on Postcard





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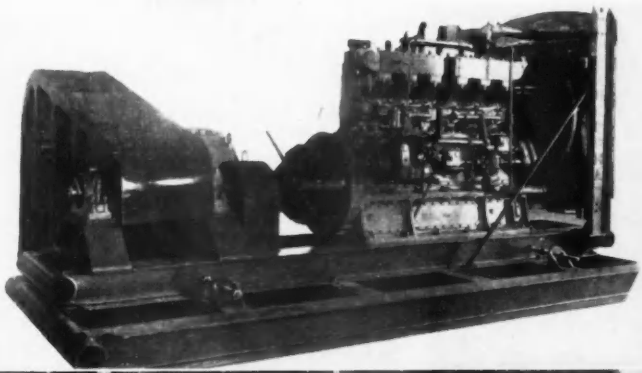

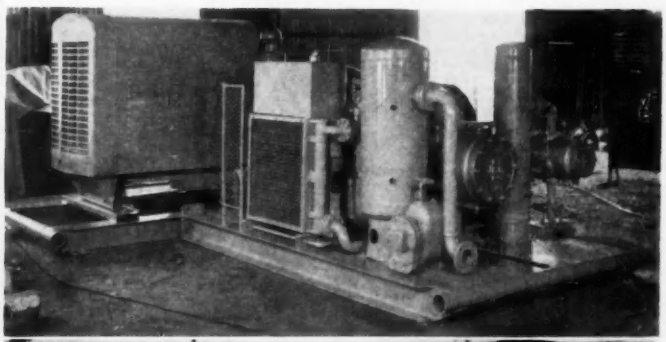

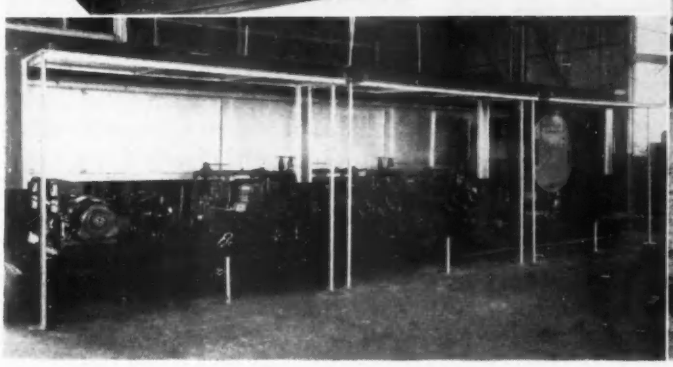

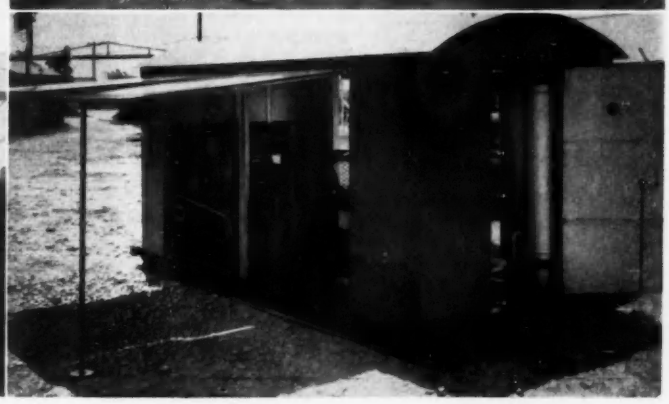

Save time! Keep informed! Circle numbers on postcard, page 89, corresponding to items on this page.

Welding Electrodes

A pocket-size booklet has been released by General Electric describing the application, chemical analysis, and mechanical properties of G-E welding electrodes. The booklet contains an electrode trouble-shooting chart, which specifies the number of electrodes per pound, and an explanation of the significance of AWS nomenclature.

Circle No. 38 on Postcard

Proportioning Pump

American Instrument Company, Inc., describes a chemical proportioning pump which displaces all liquid in the cylinder at every stroke, with strokes which are adjustable while the pump is running. Both the stroke adjustment mechanisms and the legible indicating scale are stationary while the pump is running. The piston is reciprocated by a positive mechanical linkage to the crank arm. Check valves can be removed with ease for cleaning or replacement. These pumps are available in simplex style, duplex, and a combination duplex style.

Circle No. 39 on Postcard

Pipe Threading Machines

A new bulletin released by William K. Stamets Company is entitled "Pipe Threading Machines" and describes Stamets machines designed primarily for accurate threading of oil field pipe to comply with American Petroleum Institute specifications. Specifications of other Stamets pipe threading machines and descriptions of the construction and operation of the machines is also given.

Circle No. 40 on Postcard

Rotary Hose Rack

Goodall Rubber Company of Texas is now manufacturing a special skid-mounted rotary hose rack for storing and transporting hose between locations. The rack eliminates careless handling of the hose which may result in damage. A hose is wrapped around a shell five feet in diameter which rotates on roller bearings. As the hose is unwound it runs through an eye which prevents kinking and damage to the hose. The unit is mounted on skids six feet by ten feet. Small tools may be carried in the bin formed in the middle of the rack.

Circle No. 41 on Postcard

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Made in 1½, 2, 3, 5, 10, 15 and 20 gallon sizes. Push-Button Faucet at slight additional cost.
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Made in 2, 3, 5, 8, 10, 15 and 20 gallon sizes with Push-Button Faucet.
KEEP PURE DRINKING WATER ALWAYS HANDY
GOTT Water Coolers are the convenient way to keep drinking water handy to the worker, protect it from impurities. Their exclusive construction keeps water cool for long periods. Snug-fitting, large, removable top, handy non-leaking push-button faucet. GOTT Water Cans for handy field use. Your supply store has them, get one today!
STANDARD OF THE OIL FIELDS
Insist on the Genuine
H. P. GOTT MFG. CO.
WINFIELD, KANSAS

Gasoline Sweetening

A process for sweetening and inhibiting gasoline in a single step is described in a bulletin just published by Tennessee Eastman Company entitled "Tenamene 2 Inhibitor Sweetening." The Tenamene 2 is recommended for converting mercaptans to disulfides in a process which does not affect the inhibitor. The inhibitor therefore remains in the gasoline to retard the formation of gums during storage.

Circle No. 42 on Postcard

Instrumentation

A description of the ultra-modern graphic control panel for the new White House air-conditioning system is one of the features of Minneapolis Honeywell Regulator Company's third quarter issue of "Instrumentation." Informative material on Teflon valve packing, instrument courses, and industrial uses and installations is included in the booklet.

Circle No. 43 on Postcard

Reciprocating Actuator

Bonnot Company has just issued a bulletin on Hydromotors, a division recently purchased by the firm. The Hydromotor unit is a reciprocating rotary actuator which employs air, oil or other proper fluid medium, and provides equal power in either direction. Self-contained and sealed, the Hydromotor excludes dirt and grime with the exception only of the impurity in the fluid or air supply.

Circle No. 44 on Postcard

Relief Valves

Three new catalogs describing Texsteam Corporation products are now available. Safety and relief valves, chemical injectors and proportioning pumps are each described with other pertinent information in the new catalogs. Texsteam's portable boilers are covered in a bulletin which describes both stationary and portable installation.

Circle No. 45 on Postcard

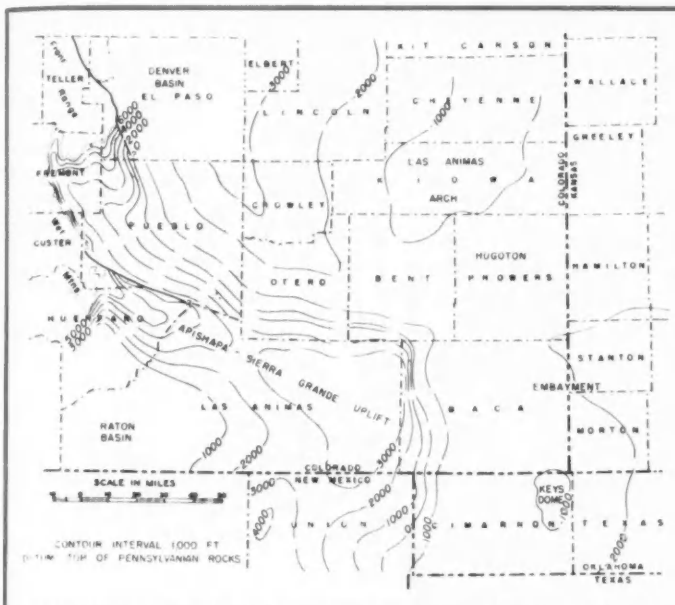


FIGURE 1. Structure of pre-Pennsylvanian rocks in southeastern Colorado.

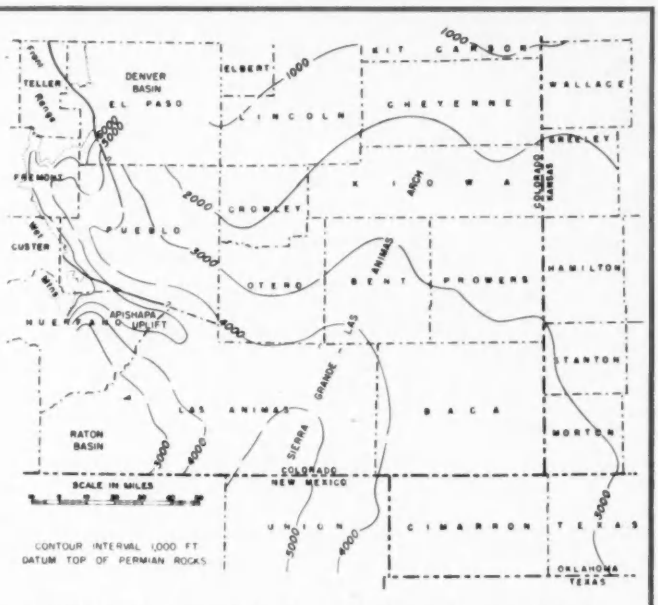


FIGURE 2. Structure of Permian rocks in southeastern Colorado.

What About Southeastern Colorado?

- **Discoveries in Kansas focus attention on area.**
- **Exploration hindered by correlation difficulties.**
- **Here's an outline of general structure of region.**

By JOHN C. MAHER

U. S. Geological Survey, Tulsa

RECENT DISCOVERIES of oil and gas in the Pennsylvanian rocks of western Kansas have directed attention again to the prospects in southeastern Colorado. Exploration has been hindered in this region by correlation difficulties resulting from facies changes in both the Permian and the Pennsylvanian rocks beneath the High Plains of southeastern Colorado. This article, based primarily on work done in preparing Oil and Gas Chart OC 46, recently released by the U. S. Geological Survey, outlines the general structure of the area and suggests correlations of the Permian and Pennsylvanian rocks from western Kansas to the Front Range in Colorado. The correlations and age designations presented in this article are not necessarily accepted by the U. S. Geological Survey.

Structural Features

The principal structural features of southeastern Colorado are indicated by structural contours on Figures 1 and 2. Figure 1 is contoured on the top of the pre-Pennsylvanian rocks, which is the base of the Pennsylvanian except on the Apishapa-Sierra Grande uplift and along the mountain front, where Permian beds rest directly on pre-Pennsylvanian rocks as a result of overlap. Figure 2 is contoured on the top of the Permian rocks. The constrasting structure shown on the two maps reflects the structural development during Pennsylvanian and Permian time. The structure of the lower Pennsylvanian beds is similar to that shown in Figure 1, whereas the structure of the Middle and Upper Pennsylvanian and the Permian beds is similar to that shown in Figure 2.

The structural backbone of the region is formed by the Front Range, the West Mountains and a buried ridge in the pre-Cambrian basement that extends from the Wet Mountains southeastward to the eastern border of Las Animas County. Here it is offset southward into New Mexico, possibly connecting with the buried Amarillo Mountains of the Texas Panhandle and the exposed Wichita Mountains of western Oklahoma. Major faults, perhaps in part extensions of the Ute Pass and Wet Mountain faults, may be associated with the steep dips along the north and east flanks of the buried ridge. In southeastern Colorado this ridge is broken into two features that have separate names—the Apishapa Uplift for the high area in eastern Huerfano County and northwestern Las Animas County, and the Sierra Grande

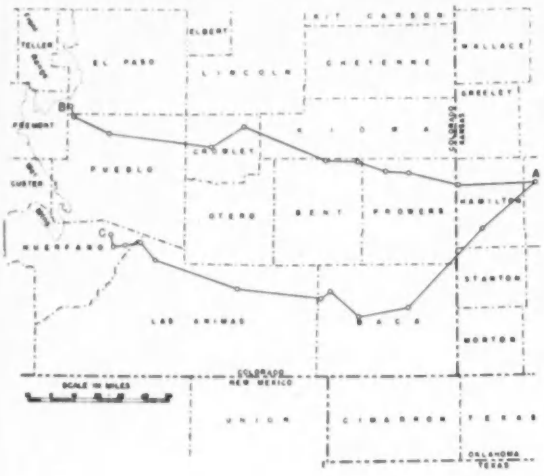


FIGURE 3. Location of cross sections southeastern Colorado.

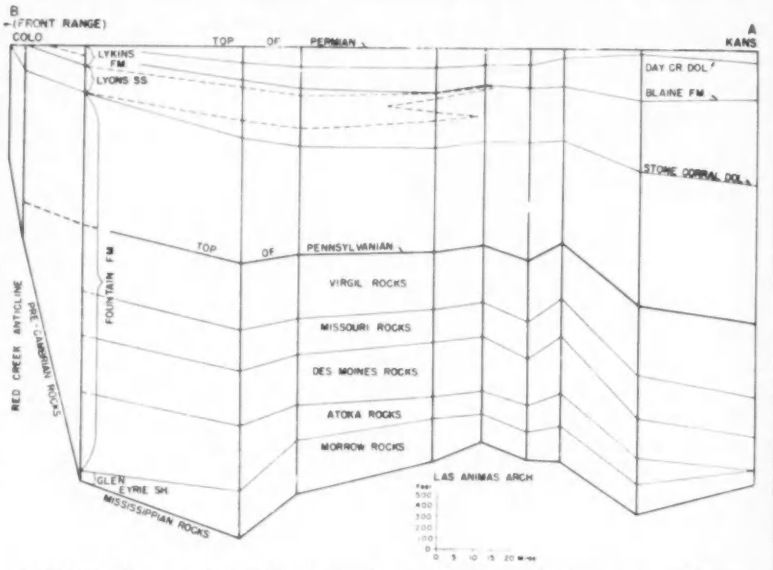


FIGURE 4. Cross section of Permian and Pennsylvanian rocks from western Kansas to Front Range, Colorado.

Uplift for the high area in eastern Las Animas County, Colorado, and western Union County, New Mexico. The term Apishapa-Sierra Grande Uplift is used to indicate the essential unity of these uplifts which served as sources of sediment during most of Pennsylvanian and Permian time.

Another important positive feature of the region, although of different origin, is the Las Animas arch which, in the Mississippian rocks, is a southwest plunging anticlinal nose in Cheyenne and Kiowa counties, Colorado, separated from the northwest trending Apishapa-Sierra Grande Uplift by a saddle (Figure 1). This same feature is represented in the Permian rocks (Figure 2) by a broad arch plunging off the Sierra Grande Uplift in southern Bent County northeastward across Kiowa, Cheyenne and Kit Carson counties.

Three Major Basins

Parts of three major structural basins are present in southeastern Colorado—the Hugoton embayment of the Anadarko Basin, the Denver Basin, and the Raton Basin. The Hugoton embayment of the Andarko Basin extends northwestward from southwestern Kansas to Bent County, Colorado. It is flanked on the south by the Sierra Grande Uplift and separated from the Denver Basin on the west by the northeast-trending Las Animas arch. The Keyes dome in Cimarron County, Oklahoma, is included within the embayment.

The Denver Basin extends in a northwestward direction between the Las Animas arch on the east and the Apishapa-Sierra Grande Uplift, the Wet Mountains, and the Front Range on the south and west. It includes two embayments—a large one in Pueblo and Fremont counties called the Canon City embayment and a smaller one in El Paso County called the Colorado Springs embayment. An anticlinal nose—the Red Creek anticline—protrudes into the Denver Basin in the southwestern corner of El Paso County and the northwestern part of Pueblo County.

The Raton Basin, which extends into New Mexico, occupies the southern part of Huerfano County and the western part of Las Animas County, Colorado. It has not been defined in the Paleozoic rocks by drilling, and its shape as outlined on this map is only diagrammatic. It appears to be separated from the Denver Basin by the Apishapa Uplift but the two basins could be connected across the southern end of the Wet Mountains.

Correlation

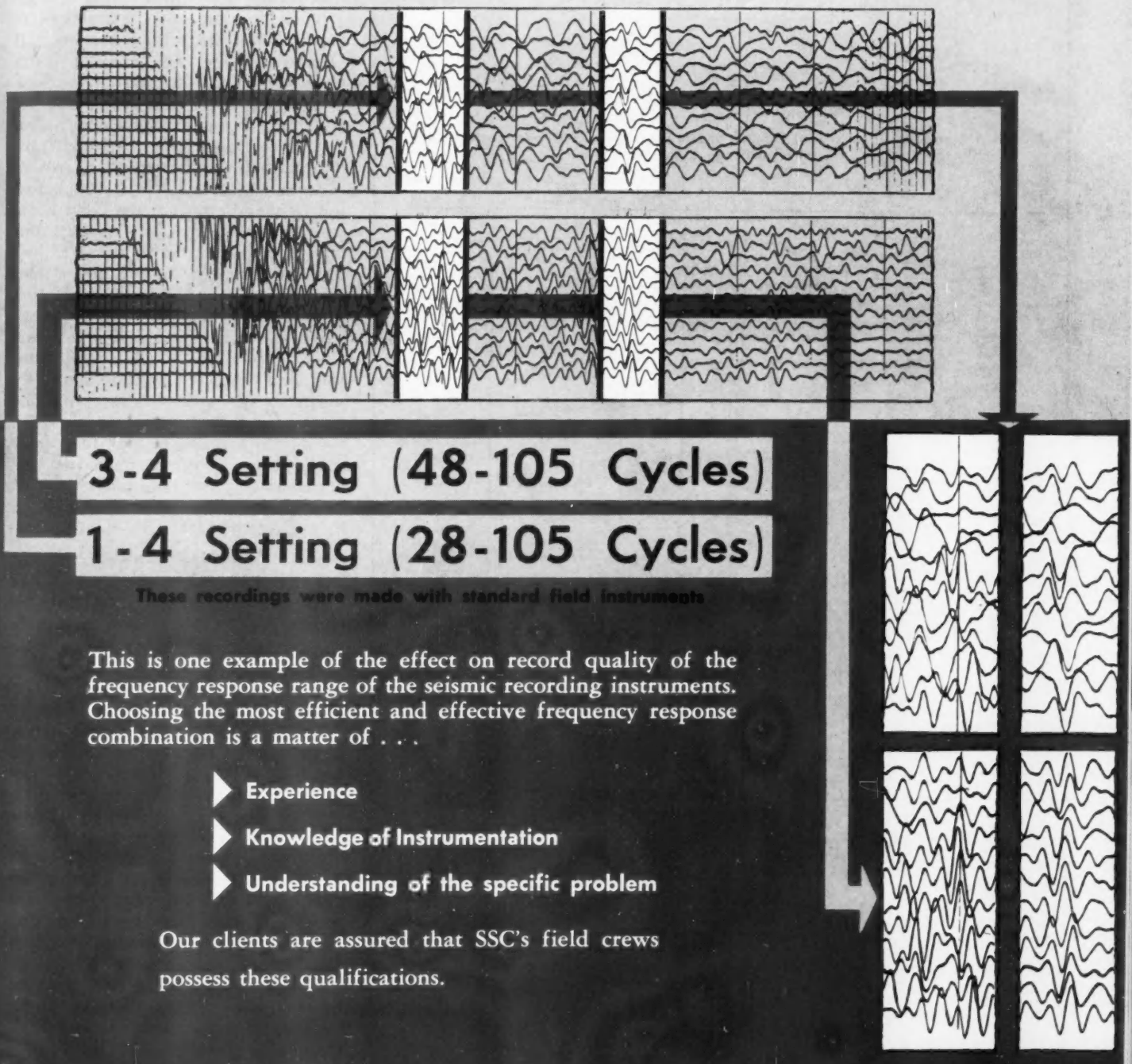
The Permian and Pennsylvanian rocks in southeastern Colorado have been subdivided and correlated by

TABLE 1
Correlation of Permian and Pennsylvanian Rocks Along the Southern Front Range of Colorado With Their Kansas Equivalents

Western Kansas	Southern Front Range of Colorado
PERMIAN ROCKS	
Rocks of Guadalupe Age	
Taloga Formation	Lykins Formation
Day Creek Dolomite	Upper "Crinkly Limestones"
Whitehorse Sandstone	
Rocks of Leonard Age	
Nippewalla Group	
Dog Creek Shale	
Blaine Formation	Lower "Crinkly Limestones"
Flowerpot Shale	
Cedar Hills Sandstone	Lyons Sandstone
Salt Plain Formation	
Harper Sandstone	
Sumner Group (Stone Corral Dolomite at Top	Fountain Formation ("Contact Limestone" at Top in Red Creek Area)
PERMIAN (?) ROCKS	
Rocks of Wolfcamp Age	
Carboniferous (Pennsylvanian) Rocks	
Rocks of Virgil Age	
Rocks of Missouri Age	
Rocks of Des Moines Age	
Rocks of Atoka Age	
Rocks of Morrow Age	Glen Eyrie Formation

Basic Methods of Improving Seismic Records . . .

The Effect of SELECTIVE FILTERING



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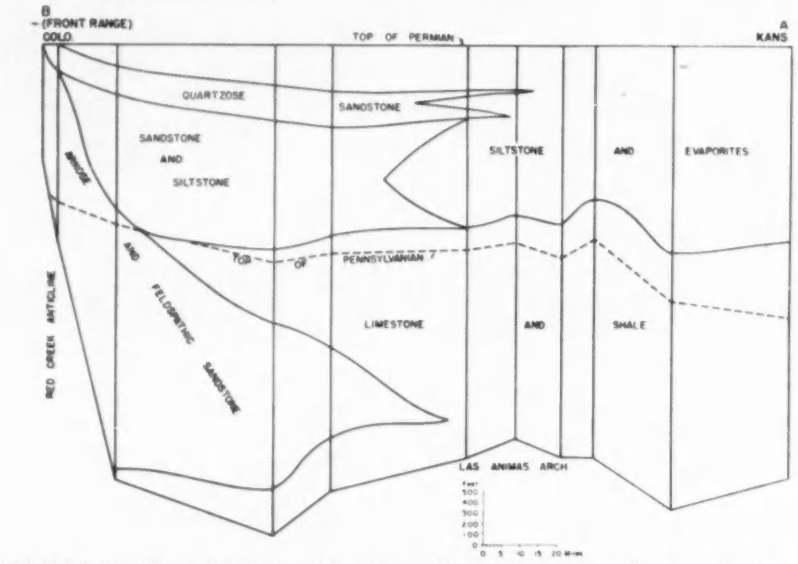


FIGURE 5. Significant lithologies of Permian and Pennsylvanian rocks from western Kansas to Front Range, Colorado.

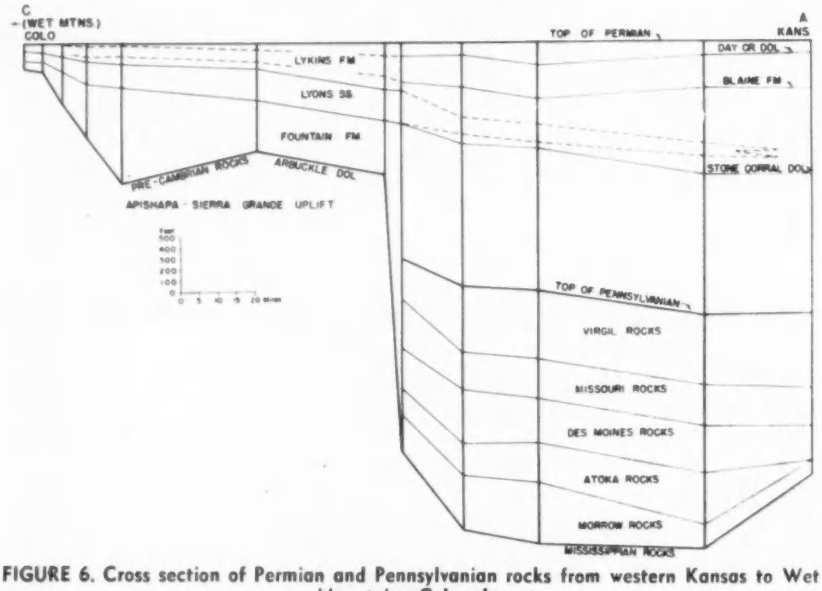


FIGURE 6. Cross section of Permian and Pennsylvanian rocks from western Kansas to Wet Mountains, Colorado.

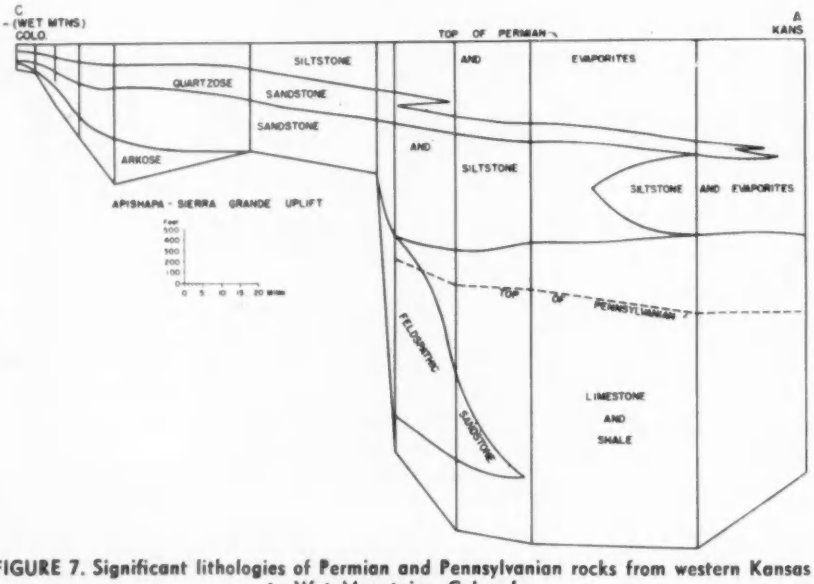


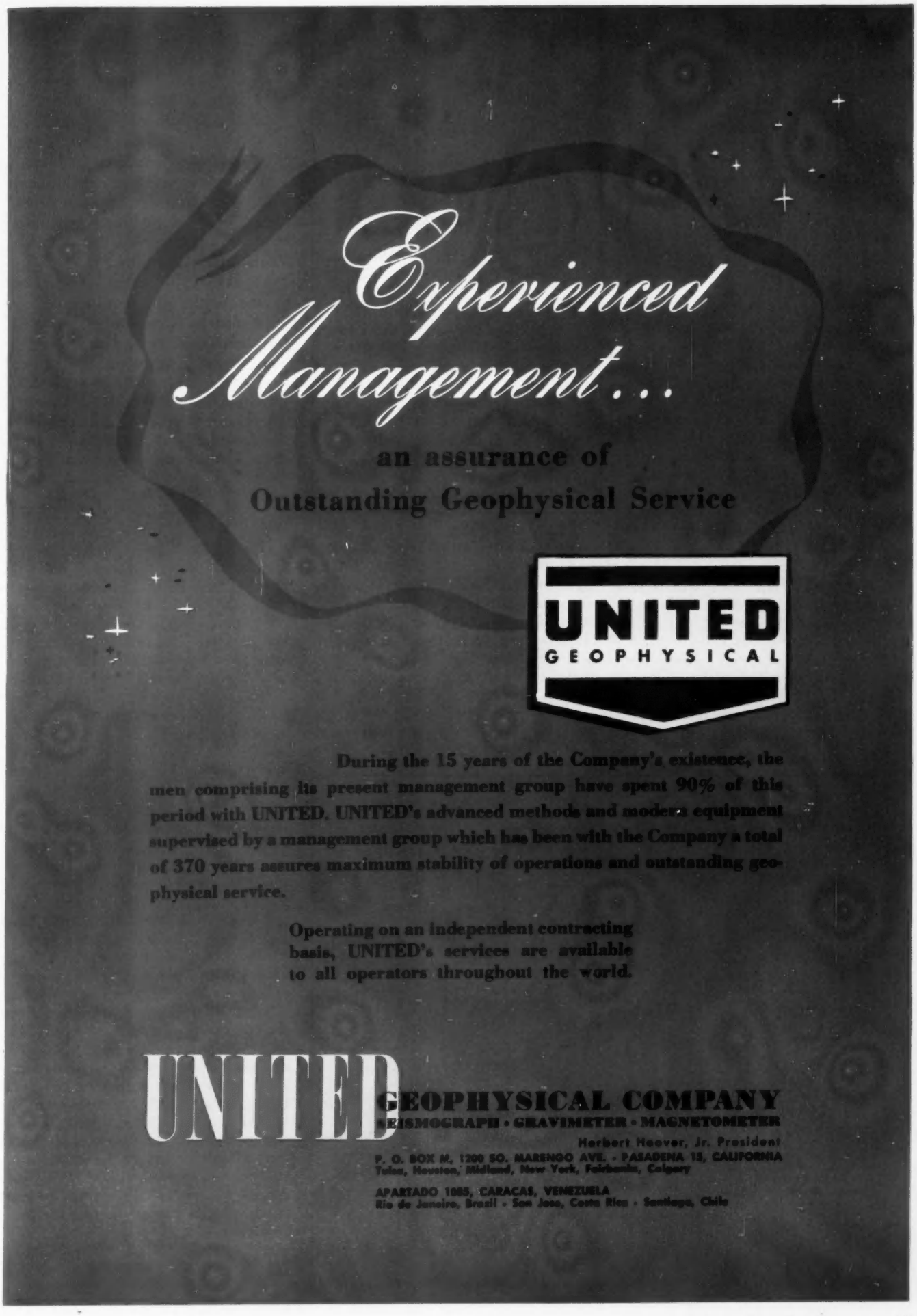
FIGURE 7. Significant lithologies of Permian and Pennsylvanian rocks from western Kansas to Wet Mountains, Colorado.

tracing well-known lithologic units of central Kansas westward, well by well, to the mountain front. Figure 3 shows the course of two cross sections across southeastern Colorado prepared for this purpose. Cross section A-B extends from the Patterson Pool in Kearny County, Kansas, to the Red Creek anticline adjacent to the Front Range in El Paso County, Colorado. Cross section A-C starts with the same well in Kearny County, Kansas, and extends southwestward to the Sierra Grande Uplift and then westward to the Wet Mountains in Huerfano County, Colorado.

The Permian and Pennsylvanian beds thicken along cross section A-B (Figure 4) into the Denver Basin mainly by the addition of a thick wedge of lower Pennsylvanian rocks, and then thin rapidly by overlap on the Front Range. The principal subdivisions of the Pennsylvanian of western Kansas can be traced across the Denver Basin into the Glen Eyrie and Fountain formations of the Front Range. The Permian subdivisions lose their identity in easternmost Colorado but the larger units can be delimited by certain thin key beds that carry through. These are the Stone Corral dolomite, the Blaine formation, and the Day Creek dolomite. By means of these key beds it can be established that the Lykins formation, the Lyons sandstone, and the upper part of the Fountain formation are equivalent to the Permian section of Kansas.

Lithologic Changes

Figure 5 depicts the lithologic changes in the Permian and Pennsylvanian rocks along cross section A-B. The limestone and shale sequence suggests an offshore marine environment for the most part. However, some of the green and black shales at the base of the sequence (Morrow beds) contain lignite seams and plant fossils, which indicate a lagoonal environment in part. The arkose to feldspathic sandstone sequence suggests mixed continental and near-shore marine conditions. The thin limestones containing marine fossils interbedded in the arkose at the west end of this section support the conclusion that most of the arkose on this section is near-shore marine in origin. The sandstone-siltstone-evaporite sequence, embracing most of the Permian rocks, suggests mixed continental and shallow marine (relict sea) conditions; and the quartzose sandstone indicates a littoral to shallow marine environment. This is the equivalent of the Lyons sandstone of the Front Range, which W. O. Thompson has fairly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well proved to be mainly a beach sand along the outcrop. These lithologic changes through the Permian and Pennsylvanian section point toward a transgressive sea during most of Pennsylvanian time and a regressive sea in Permian time, with a minor readvance and final retreat near the close.

Cross section A-C (Figure 6) shows the thickening of Permian and Pennsylvanian rocks in the western part of the Hugoton embayment mainly by addition of lower Pennsylvanian beds and then the abrupt wedging out of all Pennsylvanian rocks on the eastern flank of the Sierra Grande Uplift. From closely spaced wells that could not be shown on this cross section, it is known that rocks of Morrow age extend higher on the flanks of the uplift than the middle Pennsylvanian rocks. This serves to date the major movement of this uplift as late Morrow. The lithologic changes of the Permian and Pennsylvanian rocks in this direction are shown in Figure 7. The environmental conditions mentioned in connection with cross section A-B seem also to have existed here.

A summary of the correlations established across southeastern Colorado is shown in Table 1. The Lykins formation of the Front Range is correlated with the rocks of Guadalupe age and the upper half of the Nippewalla group of Kansas. The "upper and lower crinkly limestones" are approximately equivalent to the Day Creek dolomite and the Blaine formation of Kansas. The Lyons sandstone of the Front Range is represented in Kansas by the Cedar Hills, Salt Plain, and Harper formations. The Fountain formation is equivalent to the Sumner and Wolfcamp rocks of the Permian and all of the Pennsylvanian except the Morrow. The "contact limestone" at the top of the Fountain formation in the Red Creek area probably represents the western extremity of the Stone Corral dolomite. The Glen Eyrie shale exposed near Colorado Springs is correlated with rocks of Morrow age.

Oil and inflammable gas (CO_2 and helium have been found in this area) have not been discovered in Permian and Pennsylvanian beds in southeastern Colorado, although several fields have been developed in adjacent areas of western Kansas and the Oklahoma Panhandle (see Figure 8). The Hugoton gas field—the largest gas field in the world—occupies much of southwestern Kansas and parts of the Oklahoma and Texas Panhandles. Its western boundary passes through Stanton and Morton Counties, Kansas, and Texas County, Oklahoma. The gas is produced from a probable stratigraphic trap formed by a facies change in porous limestone and dolomite beds of lower Permian age on an eastward-dipping regional structure. The Patterson Pool (T22 S R38 W) of Kearny County, Kansas, the Richfield Pool (T32 S R40 W) of Morton County, Kansas, and the Keyes (T5 S R8 E) and South Keyes (T3 and 4 S R8 E) Pools of Cimarron County, Oklahoma, produce oil and gas from unconformity sands on local structures—the Patterson Pool produces oil from the basal Cherokee sandstone, the Richfield Pool produces gas and condensate from the basal Atoka sandstone, and the Keyes and South Keyes Pools produce oil and gas from the basal Morrow sandstone.

Encouraging shows of oil have been reported in beds of Missouri (Lansing and Kansas City) and Des Moines (Marmaton) age in wells drilled on the Las Animas arch in Cheyenne, Kiowa, and Prowers counties, Colorado. Recently commercial quantities of oil were found in beds of Des Moines (Marmaton) age in Cheyenne County, Kansas, which is north of this area but adjacent to Colorado. The possibilities for production from the porous limestones of both Missouri and Des Moines age in Colorado appear to be good, particularly if reef-like developments can be found fringing the more positive elements in the basins. In addition there is always present the chance of oil and gas accumulations in the basal sandstones of Cherokee, Atoka, and Morrow age, and in the coarse arkosic sandstones overlapped along the positive elements.

About the Author

JOHN C. MAHER, supervising geologist, Fuels Branch, U. S. Geological Survey, Tulsa, received his A.B. degree in 1935 and M.S. in 1937 from the University of Nebraska. He later did graduate work at Louisiana State University. He began geological work with the Nebraska Geological Survey in 1936. He joined Shell Petroleum Corporation at Tulsa in 1937 and became a member of the U. S. Geological Survey in 1938.

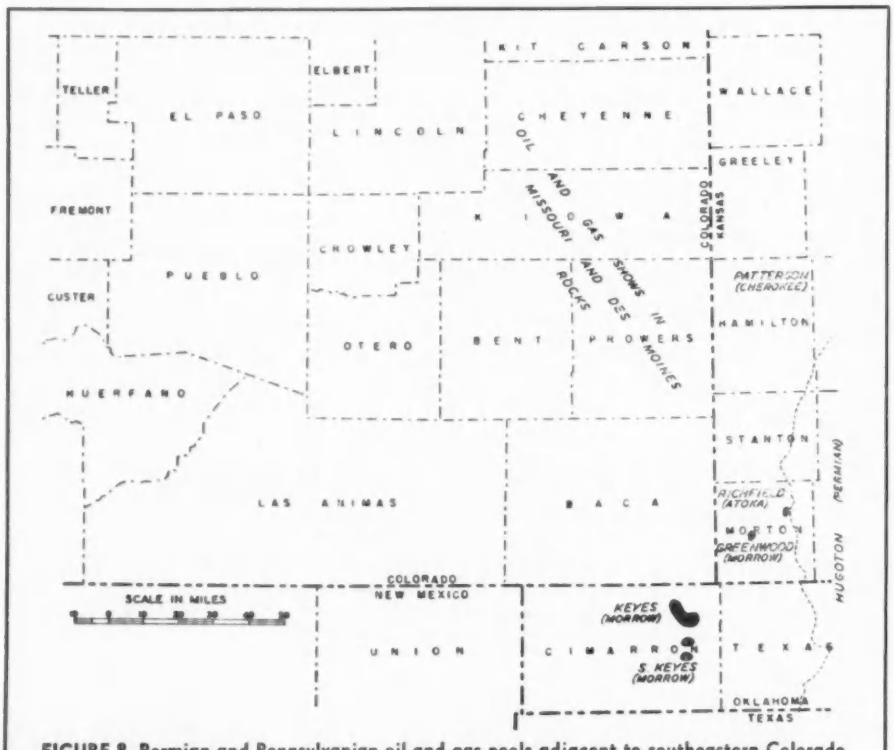

FIGURE 8. Permian and Pennsylvanian oil and gas pools adjacent to southeastern Colorado.

ACKNOWLEDGMENT

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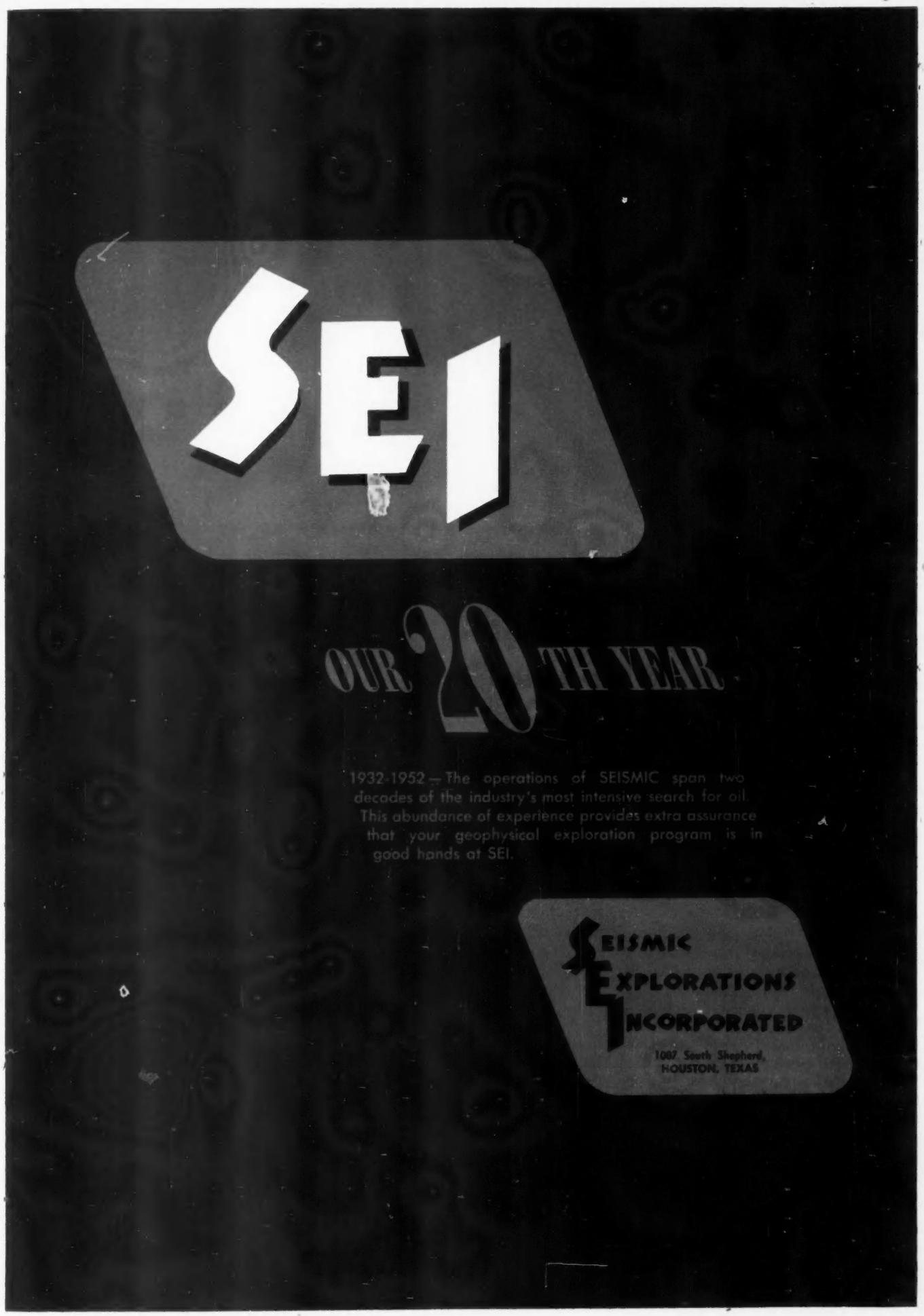
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FIGURE 1. Regional map of central Gulf coastal embayment showing principal geologic features.

Louisiana-Arkansas Region May Yield Additional Oil

Upper and lower Cretaceous sediments of area promise more oil after yielding 1½ billion barrels.

By T. H. PHILPOTT
Stratigrapher and Paleontologist
The Carter Oil Company, Shreveport

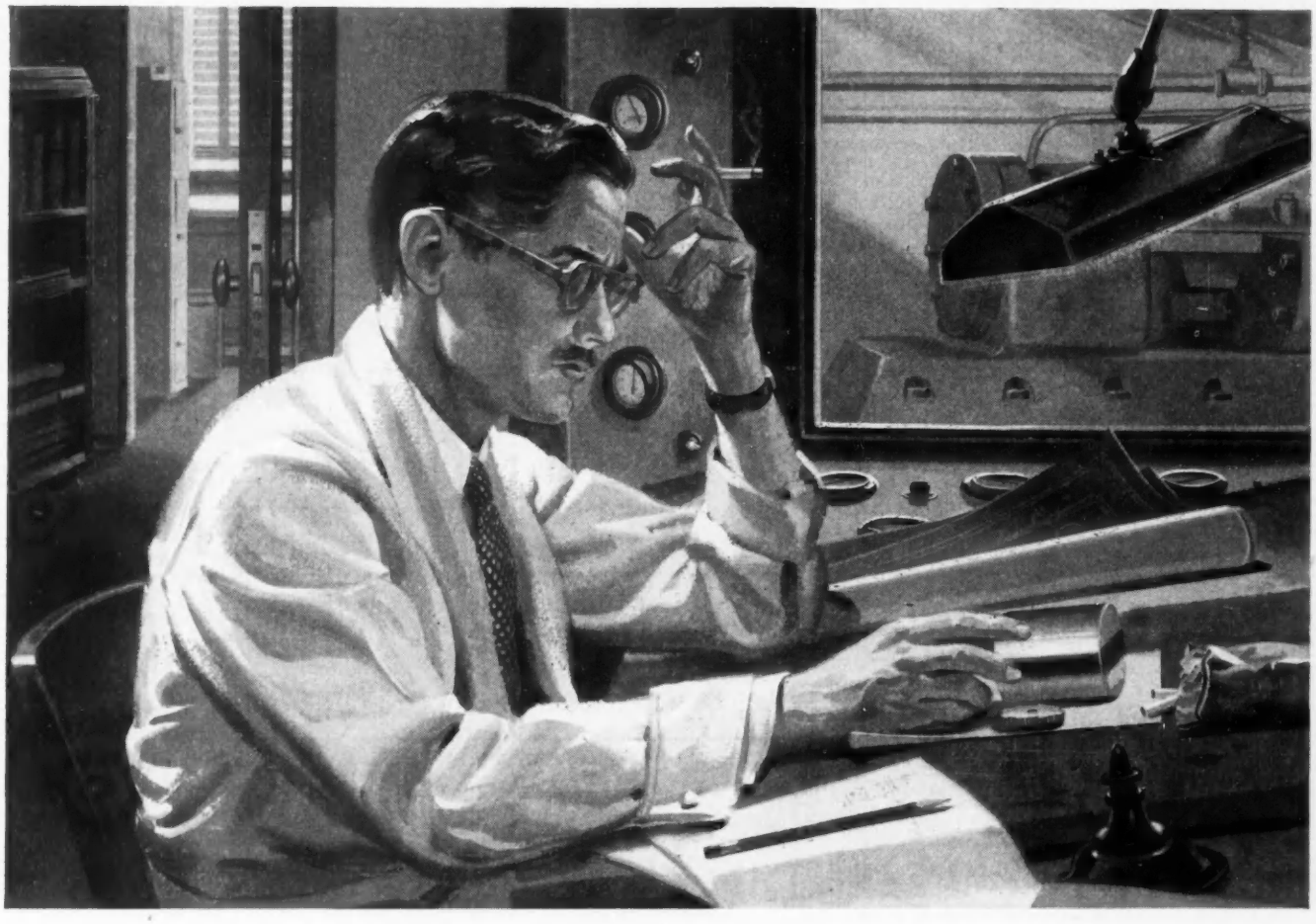
CONSIDERING THAT the Upper and Lower Cretaceous sediments in North Louisiana and South Arkansas have produced approximately 1½ billion barrels of oil it is obvious that geologists should make every effort to unravel the geologic history of the periods. Who can say how much additional Cretaceous oil still remains to be found in this area? Certainly this is a fertile field for study, although many regional and local problems remain unsolved. This outline of the regional geology of the Cretaceous describes in a general way the events that have transpired in geologic time throughout Lower and Upper Cretaceous, and discusses briefly the significance of regional structural elements such as the Ouachita Mountains, Monroe Uplift, Sabine Uplift, Desha Basin and the Interior Sale Dome Basin.

Isopach maps of the Gulf and Comanche[1] Cretaceous tend to show depo-centers as well as margins of the basins. The Pre-Gulf (Upper) Cretaceous erosion is illustrated by a map showing the areal destribution of the formations below the unconformity. A north-south stratigraphic section over the Monroe Uplift is included to emphasize pertinent relationships and the importance of the unconformities at the base of the Gulf and Comanche. Local details of structure and faulting have been deleted in view of the scale of the illustrations.

The Simplified Correlation Chart of the Upper Gulf Coast (Figure 2) shows the systems, series, groups, and formations of Texas-Arkansas-Louisiana, and Mississippi-Alabama. Heavy wavy lines show important unconformities and light vertical shaded areas show formations missing on the outcrop of Arkansas, Louisiana, Mississippi and Alabama.

At the end of Jurassic time there was a withdrawal of the sea from southwestern Arkansas and, probably from most of the area north of Township 14 North. At the beginning of Lower Cretaceous time, the Coahuila sea transgressed to the north and northeast. The Ouachita Mountains must have been an old highland contributing much gravel, sand, silt and clay. Brackish water conditions prevailed throughout most of Arkansas. Generally speaking, there is a reddening and coarsening of the sediments to the north and northeast in the Hosston as well as all Trinity lithologic units. The Lower Glen Rose group consisting of the Sligo, Pine Island and Rodessa Formations was deposited by a transgressive sea. The waters were probably shallow, agitated, and of normal salinity. In the upper portion of the Rodessa formation there is evidence of a temporary shoaling of the seas as evidenced by several anhydrite members.

During Ferry Lake time there was a marked shoaling of the sea, resulting in deposition of more than 500 feet of anhydrite from saline waters,



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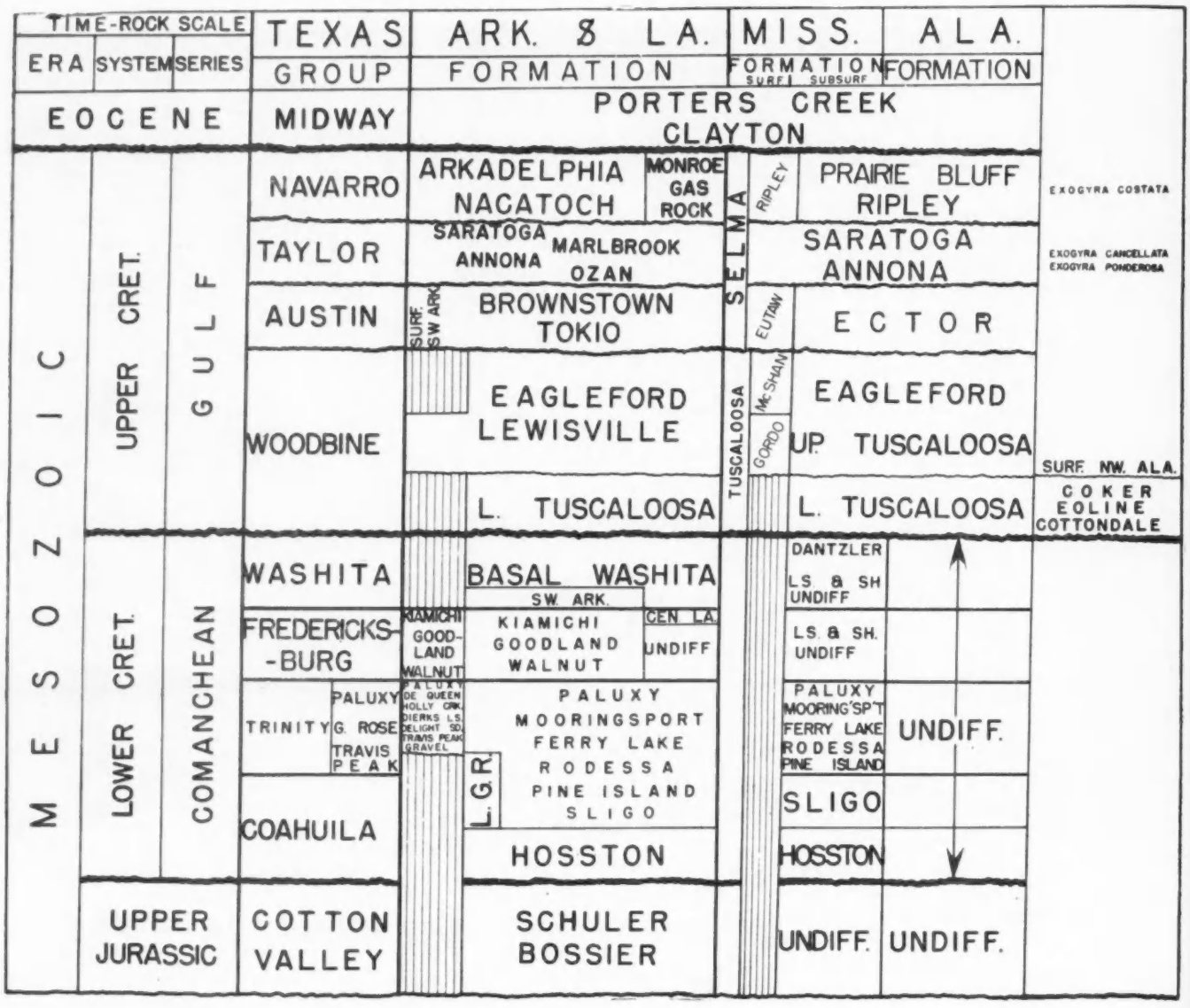


FIGURE 2. Simplified Mesozoic correlation chart of upper Gulf Coast.

probably in a broad, marginal lagoon. In upper Trinity time some 1800 feet of section belonging to the Mooringsport-Paluxy formations was deposited in water varying from shallow, to brackish and marine waters. There were short periods of time in which there was a marked shoaling of the seas, resulting in anhydrite and oolitic limestone deposition.

The northern and northeastern limits of the Mooringsport-Paluxy seas were characterized by the deposition under brackish conditions of variegated clays and sands. It is generally believed that this portion of the Paluxy-Mooringsport is a regressive deposit. Some Lower Cretaceous Charaphyta as described by Peck in the Rocky Mountain area are quite similar in many respects to the Charaphyta found in the Mooringsport-Paluxy of North Louisiana and South Arkansas. According to Peck and Reker, "it is believed that Charaphyta will never be of value for the discrimination of small stratigraphic units. They are of real value in period differentiation: continental deposits of the Jurassic, Lower Cretaceous, Cretaceous and Lower Cenozoic ages." Perhaps the greatest value of these fossils is that they are indicators of shallow-water, near shore marine environments.

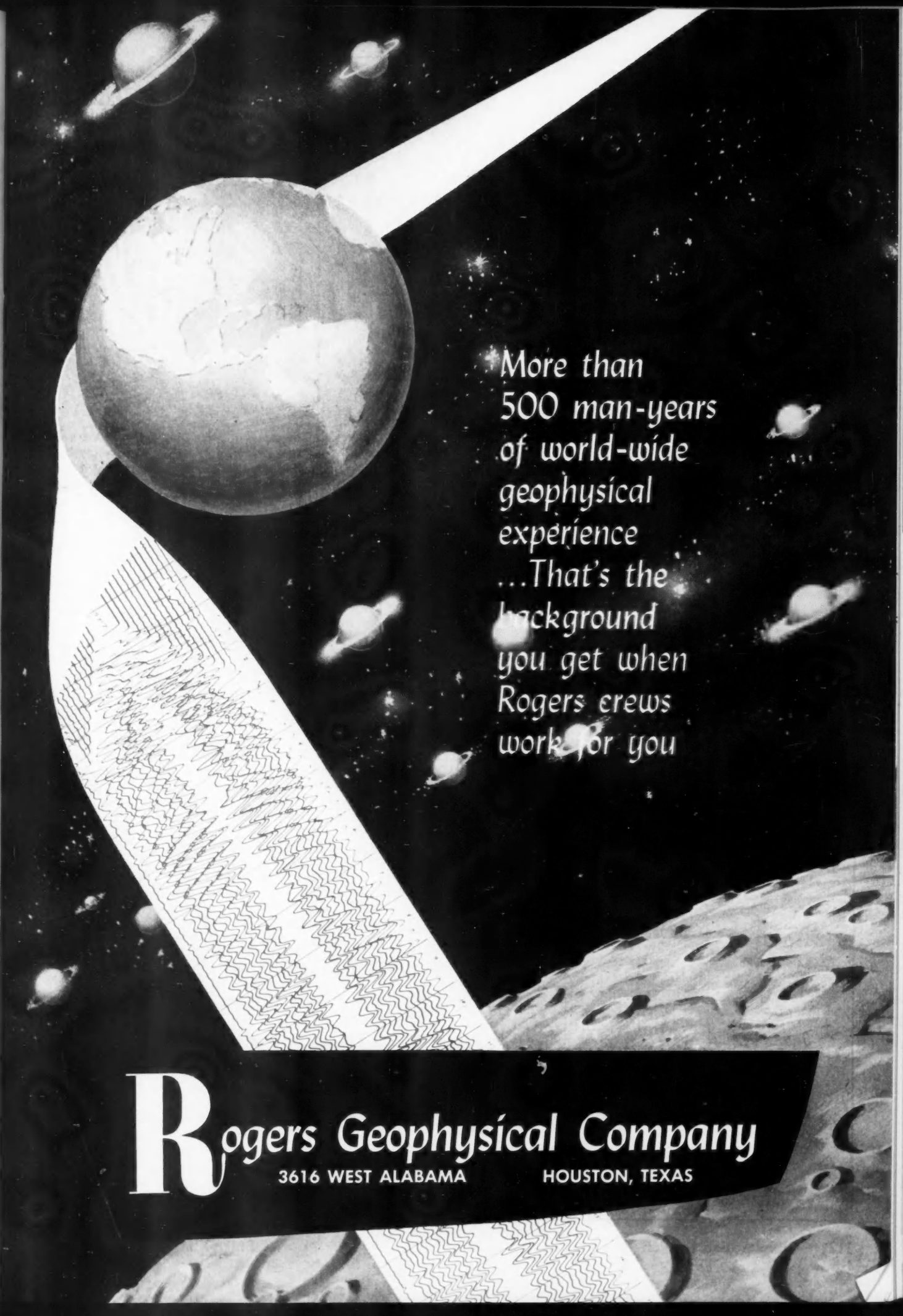
Minor Withdrawal

At the end of Trinity time there was a minor withdrawal of the sea on the periphery of the basin for a short period of time. Fredericksburg and Washita seas transgressed to the periphery of the basin, depositing limestones and dark colored shales.

At the end of Lower Cretaceous time the sea withdrew southward and there was regional uplifting, folding, faulting, and volcanism. A great deal of erosion followed this period of crustal upheaval with as much as 7000 feet of section being truncated along the limit of the Lower Cretaceous. The thickest preserved Lower Cretaceous is found in the Interior Salt Dome Basin.

The axis of this orogeny extended southeastward from the Ouachita mountains to northeastern portions of Louisiana. The areal distribution of the Pre-Upper Cretaceous formations resulting from the aforementioned orogeny and erosional stripping is shown in Figure 4. Igneous intrusions or extrusions are indicated by small squares.

The Upper Cretaceous is divided into four major groups: Woodbine, Austin, Taylor, Navarro, with minor unconformities or disconformities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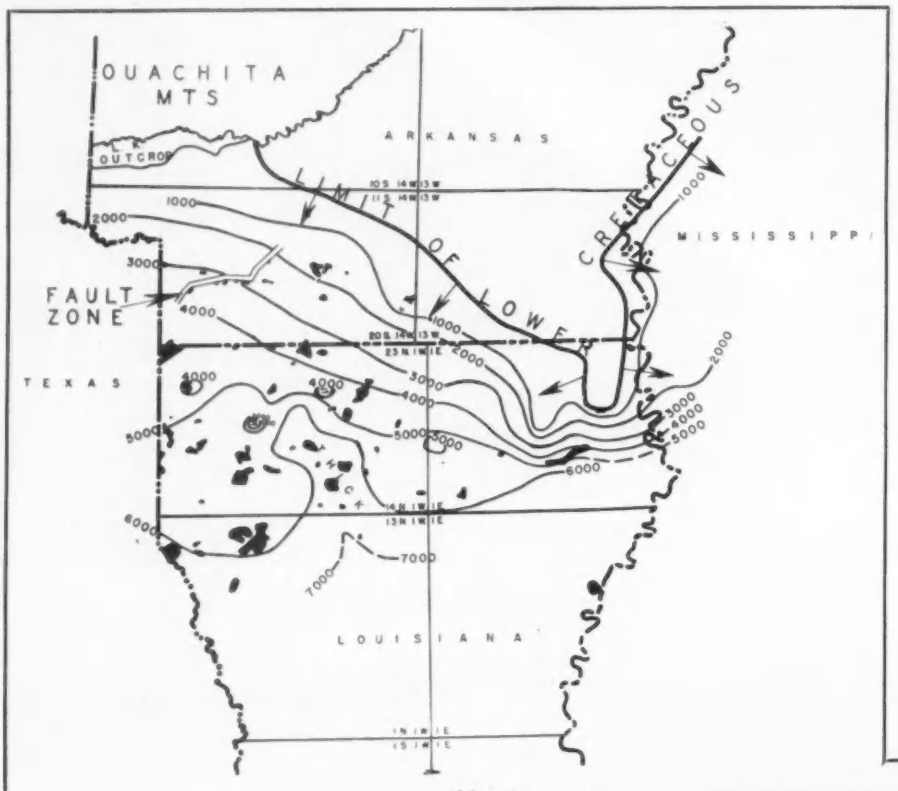
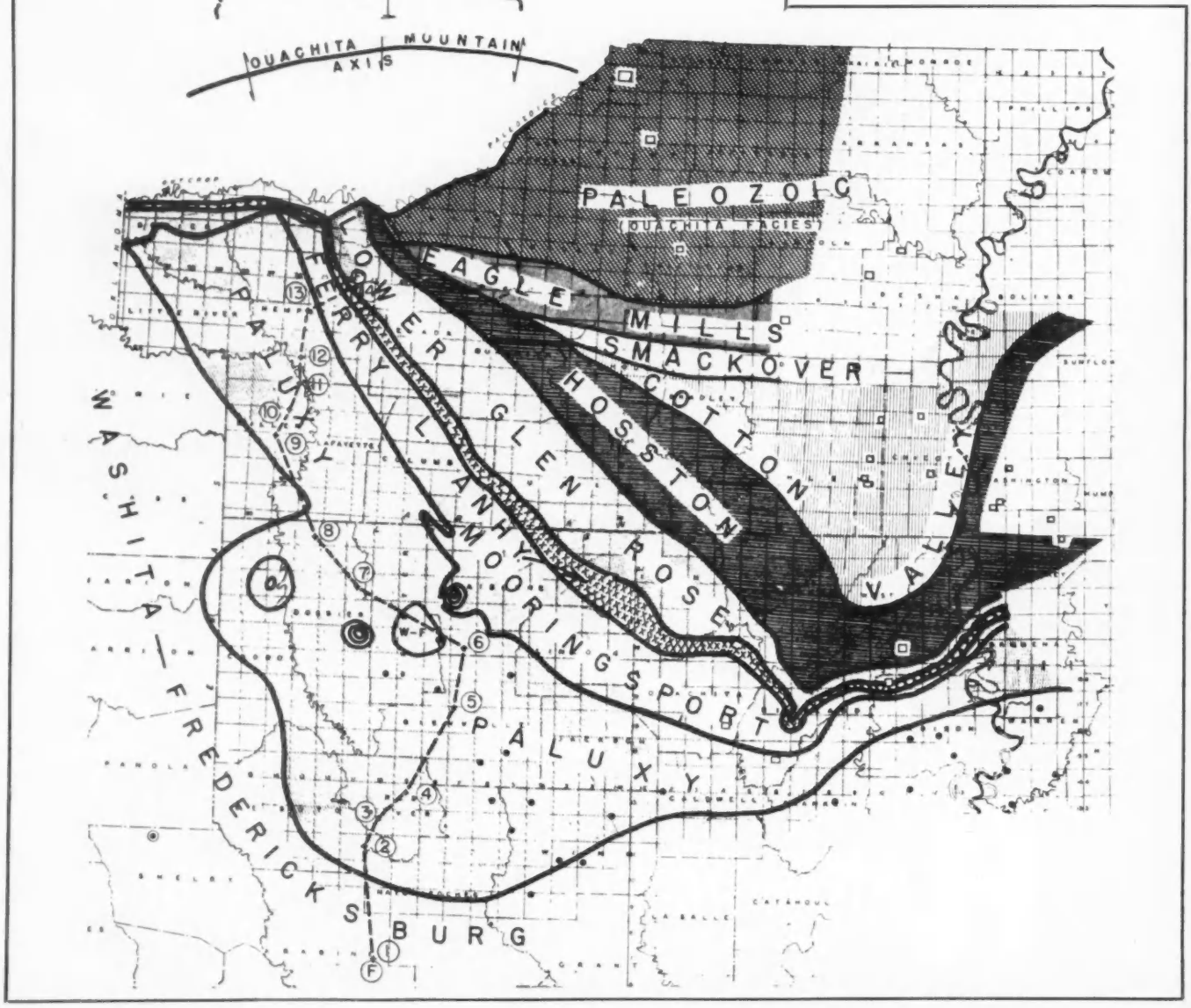


FIGURE 3 (left). Isopach map of Lower Cretaceous. Contour interval: 1000 feet.

FIGURE 4 (below). Map showing distribution of Pre-Upper Cretaceous formations in northern Louisiana and southern Arkansas.



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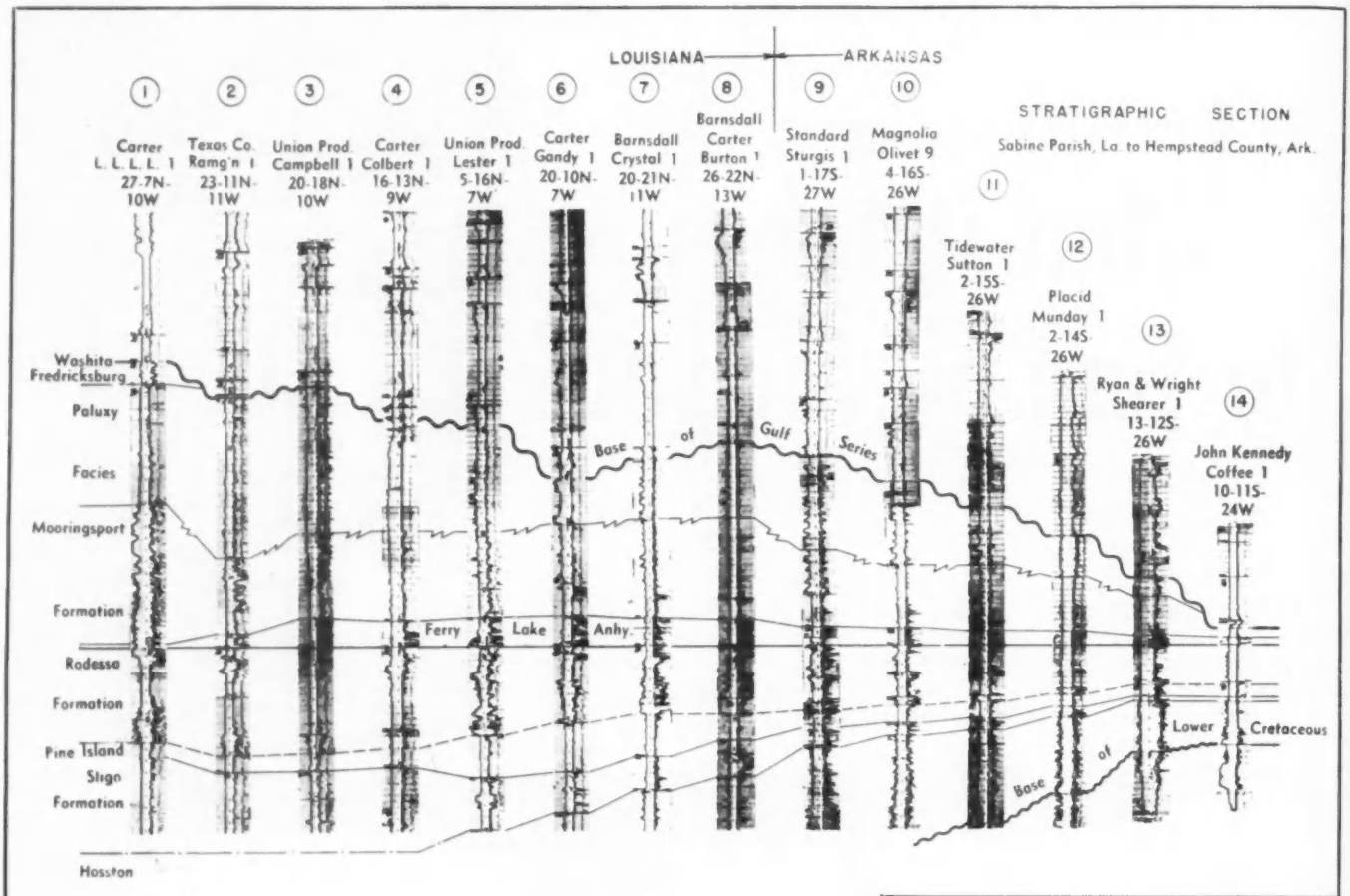

FIGURE 5 (above). Stratigraphic cross section Sabine Parish, La., to Hempstead County, Ark.

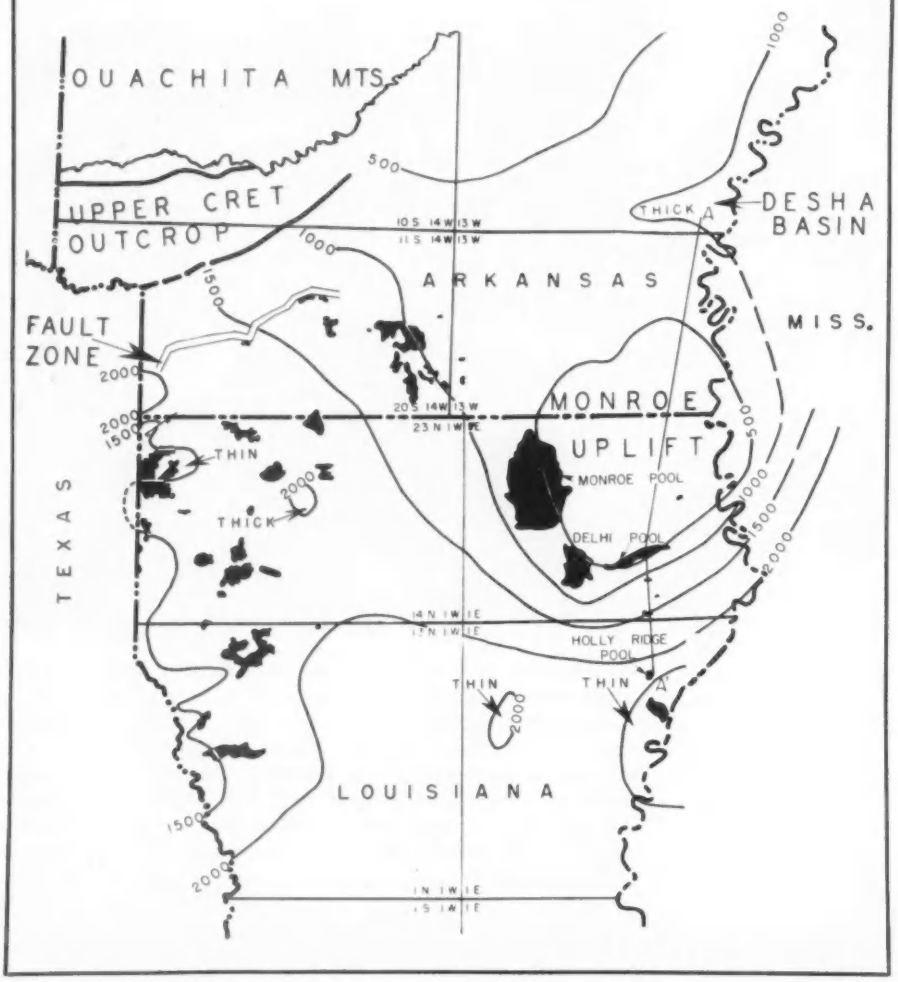

FIGURE 6 (left). Isopach map of Upper Cretaceous. Contour interval: 500 feet.

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3½	35 40	36-4 39-4 41-4	36-6 39-6 41-6	32 35	4½ Reg. 6⅝ Reg.	5½* 7⅝	2⅞ Reg. 2⅜ I.F.	3¼ 3⅝	1¹³⁄₁₆ 1¹⁵⁄₁₆	3⅝₁₆	2⅞	2¹⁵⁄₁₆	⅝₁₆	3⅝	*.165 .327
3	35 40	36-4 39-4 41-4	36-6 39-6 41-6	32 35	4½ Reg. 6⅝ Reg.	5½* 7⅝	2⅞ Reg. 2⅜ I.F.	3¼ 4⅛	1½ 1¹⁵⁄₁₆	3¹⁵⁄₁₆	3	2¹⁵⁄₁₆	⅝	4⅛	*.165 .327
3½	35 40	36-4 39-4 41-4	36-6 39-6 41-6	32 35	4½ Reg. 6⅝ Reg.	5½* 7⅝	3½ Reg. 2⅞ F.H. 3½ I.F.	4¼ 4⅝	2½ 2¹³⁄₁₆	4¹⁵⁄₁₆	3½	3¹⁹⁄₃₂	⅝	4¾	*.165 .327
4½	35 40 84	36-4 39-4 41-4 55-4	36-6 39-6 41-6 55-6	32 35 61	4½ Reg. 6⅝ Reg.	5½* 7⅝	4½ Reg. 3½ F.H. 4½ I.F.	5½* 6⅛	3¼ 3⅝ 3¹⁵⁄₁₆	5¹³⁄₁₆	4¼	4¹⁹⁄₃₂	⅝	5¼	*.165 .327
5½	35 40 84	39-4 41-4 55-4	39-6 41-6 55-6	35 37 61	6⅝ Reg.	7⅜	5½ Reg. 4½ F.H. 5½ I.F.	6⅝ 7⅜	4¾ 5⅛	6²⁵⁄₃₂	5½	5⅝	⅝	7	.327
6	35 40 84	39-4 41-4 55-4	39-6 41-6 55-6	35 37 61	6⅝ Reg.	7⅜	6¼ Reg. 5½ F.H.	6 7¾	5¼ 5¹³⁄₁₆	7⅛	6	6⅝	⅝	8	.327

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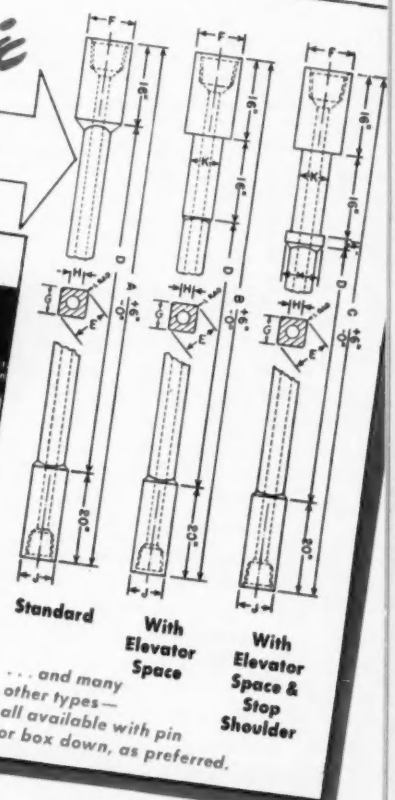
† Volume based on largest diameter of kelly



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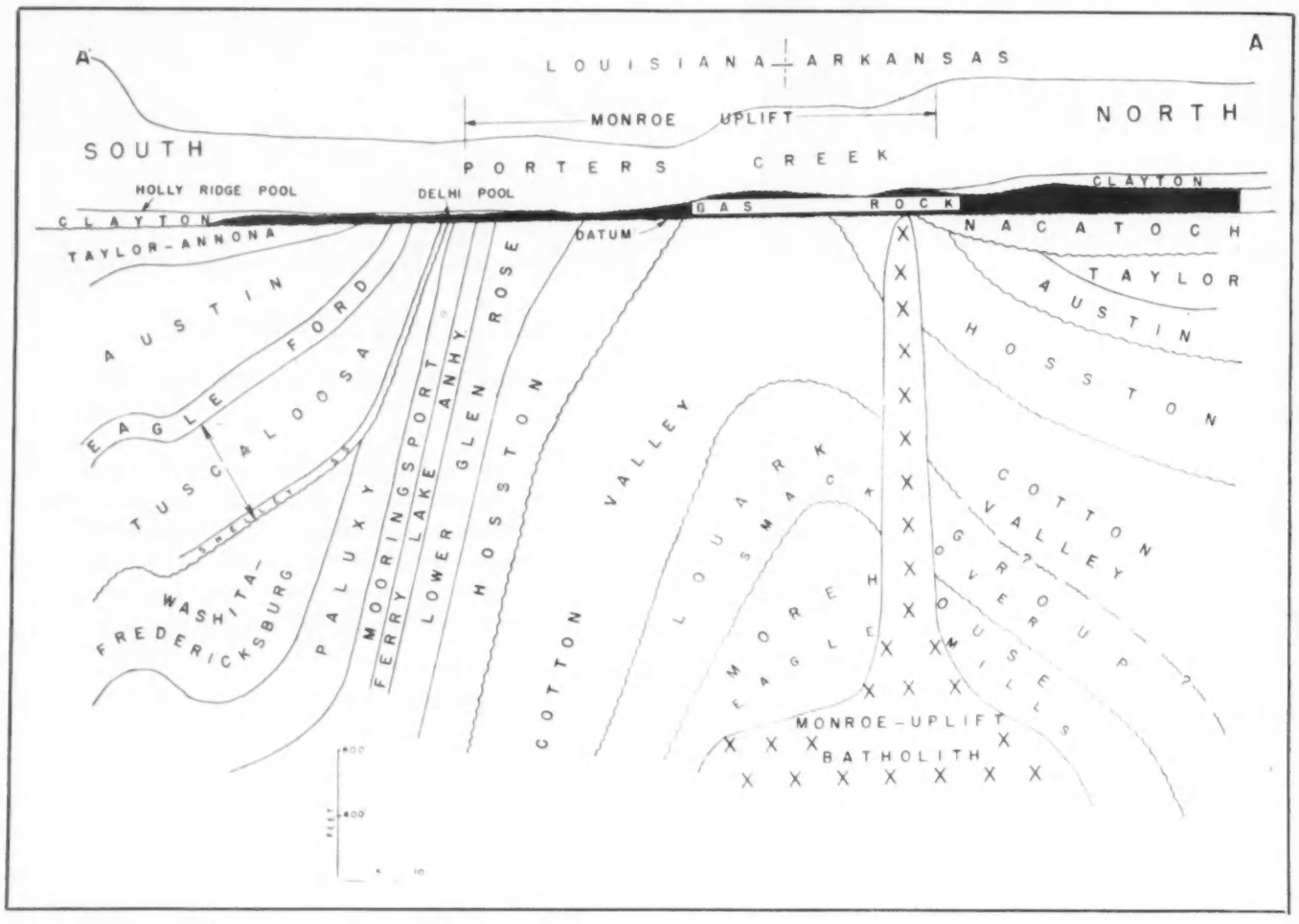

FIGURE 7. Stratigraphic cross section from Tensas Parish, La., to Chicot County, Ark. Datum: base of Monroe gas rock.

separating each group. The Woodbine group is composed largely of sandstone, vari-colored and dark shales, some gravels, and abundant volcanic material indicating that there was considerable widespread volcanic activity, possibly associated with the Pre-Upper Cretaceous unconformity. The Austin group may rest unconformably upon the Lower Cretaceous or upon the Woodbine. The Austin seas deposited sediments higher on regional features such as the Sabine Uplift and Monroe Uplift than the Tuscaloosa. The Austin is composed of sandstones and shales, with some chalks and marls.

A minor disconformity separates the Taylor from the underlying Austin. Chalk deposition was widespread during Taylor time, indicating a widespread uniformity of depositional conditions. Another minor withdrawal of the sea occurred after Taylor time and prior to Navarro. The Navarro sediments are the youngest Cretaceous known in the upper Gulf Coastal area. In many cases their present limits are close to their deposition limits. A unique depositional feature of the Navarro is the Monroe Gas Rock. This is essentially a reef type rock, composed in a large part of the fragments of large floating, warm water Foraminifera.

A major break in geologic history known as the Laramide Revolution occurred at the end of Navarro time, and although some erosion is known in this area and the faunal evidence indicates a complete withdrawal of the Cretaceous seas, there apparently was little in the way of erosion at this point in the geologic section.

The Isopach of the Upper Cretaceous is shown in Figure 6. The crest of the Monroe Uplift is outlined with the closing 500 foot contour. Oil and gas production are indicated by solid black. Regional thins on the Monroe and Sabine Uplift are separated by a thick in the intervening Interior Salt Dome Basin. Cross Section A-A, Figure 7 is a north-south diagrammatic stratigraphic cross section from Holly Ridge Pool, Tensas Parish, La., to Chicot County, Ark. The data for the section is the base of the Gas Rock. The regional arching of the late Paleozoic, Jurassic and Lower Cretaceous rocks is presumably the result of the Monroe Uplift batholith. The latter has not been penetrated by the drill to date. Note that the Gas Rock rests unconformably upon Jurassic, Lower Cretaceous and older Upper Cretaceous sediments.

Conclusions

The Hosston, a basal Lower Cretaceous, transgressive sequence was deposited upon an important regional unconformity. The Hosston may rest upon rocks varying in age from Jurassic to Pennsylvanian.

The unconformity at the base of the Upper Cretaceous is important since over 7000 feet of section has been eroded at this point in the geologic column.

The effect of the Monroe Uplift, Sabine Uplift and Interior Salt Dome Basin is shown on all isopach maps.

REFERENCE

[1] As used in this article the term Comanche is synonymous with Lower Cretaceous and the term Gulf is synonymous with Upper Cretaceous.

Exploratory Completions Fall to Five-Month Low

By CECIL W. SMITH, WORLD OIL Staff

EXPLORATORY WELL completions dropped to a five-month low during September. As drilling statistics were beginning to show more fully the impact of the pipe shortage, the month's tests fell almost to last April's level. That was contrary to the normal trend, which generally sees September's exploratory wells ranking with the year's highest.

A total of 887 wells were completed during the month to show a loss of 72 tests from the 959 recorded in August. It was the first time since April that completed tests had fallen below the 900-well level. A year before, a total of 1020 were completed in September, which shows quite plainly how drilling activity has been hampered by the steel strike.

The year's total wells, which, before the strike, were holding a 10 percent margin over those drilled in 1951, now have had their lead whittled to 3.2 percent. A month earlier, the difference between the two years' tests had amounted to 5.7 percent. To date, the current exploratory campaign has resulted in 8071 wells, an increase of 252 over the 7819 recorded in the same period of 1951. The year still holds the distinction of being the most active in history, but the margin of lead over the previous record of 1951 is fading rapidly.

From a numerical standpoint, there remains little choice between the two years' exploratory results. This year a total of 1472 tests have proved to be commercial producers for a score of 18.2 percent of the total drilled, while at the same time last year 1433 producers amounted to 18.3 percent.

Summary of Results of Exploratory Drilling

ITEM	Sept., 1952	Aug., 1952	NINE MONTHS January-September 1952	1951	Percent Diff.
Oil Discoveries	97	108	962	986	— 2.4
New Fields	71	87	734	719	+ 2.1
New Pays	26	21	228	267	— 14.6
Distillate Discoveries	12	13	103	63	+ 63.5
New Fields	10	11	90	43	+109.3
New Pays	2	2	13	20	— 35.0
Gas Discoveries	15	17	146	161	— 9.3
New Fields	14	13	118	126	— 6.4
New Pays	1	4	28	35	— 20.0
Total Discoveries	124	138	1,211	1,210	+ 0.1
Extensions to Fields	18	29	261	223	+ 17.0
Oil Fields	16	28	222	174	+ 27.6
Distillate Fields			6	14	— 57.2
Gas Fields	2	1	33	35	— 5.7
Total Prod. Tests	142	167	1,472	1,433	+ 2.7
Dry Holes	745	792	6,599	6,386	+ 3.3
Wildcats	737	787	6,387	6,100	+ 4.7
New Pays			11	11	
Outposts	8	5	201	275	— 26.9
Total Expl'tory Tests	877	959	8,071	7,819	+ 3.2
Percent Productive	16.0	17.4	18.2	18.3	
Percent Dry	84.0	82.6	81.8	81.7	

Results of Exploratory Drilling in September and First 9 Months, 1952-1951, by Districts

State or District	MONTH OF SEPTEMBER, 1952													FIRST NINE MONTHS, 1952															
	Productive Tests										Unproductive Tests				Productive Tests								Unproductive Tests			Total Dry		Total Exploratory Tests	
	New Fields			New Pays			Extensions			Total Productive					New Fields			New Pays			Extensions			Total Productive						
	Oil	Dis.	Gas	Oil	Dis.	Gas	Oil	Dis.	Gas		Wildcats	New Pays	Outposts	Total Exploratory Tests	Oil	Dis.	Gas	Oil	Dis.	Gas	Oil	Dis.	Gas	9 Mo. 1952	9 Mo. 1951	Wildcats	New Pays	Outposts	9 Mo. 1952	9 Mo. 1951	9 Mo. 1952	9 Mo. 1951
Alabama											1			1	1		1							2	3	25			25	16	27	19
Arizona																										1			1	3	1	3
Arkansas											13			13	9		1			2	1			13	17	76		1	77	75	90	92
California	3		1							4	45		3	52	25	1	6	18			21		2	73	58	279	2	27	308	362	381	420
Colorado			2							2	22			24	9	1	5	3		2	2		1	23	9	149		2	151	89	174	98
Florida																										6			6	3	6	3
Idaho																														1		1
Illinois	4		1	2			2			9	47			56	19		1	15		2	37			74	75	434			434	551	508	626
Indiana	2		1				2			5	26			31	15		1	2			12			30	43	258		2	260	294	290	337
Kansas	10		1							11	65			76	89	1	8	7			1			106	145	646			646	601	752	746
Kentucky	1									1	12			13	20			1			4			25	27	94			94	144	119	171
Louisiana	3						1			4	27			31	28	21	3	12	3		3		2	72	71	260	1	3	264	264	336	335
North Louisiana	1						1			2	16			18	9	4	3	8	3		2		1	30	33	141		3	144	169	174	202
South Louisiana	2									2	11			13	19	17		4			1		1	42	38	119	1		120	95	162	133
Michigan				1						1	19			20	14		1	6		3	4		1	29	16	178			178	231	207	247
Mississippi							1			1	11			12	8	2		2		1	3			16	15	120		3	123	112	139	127
Missouri											2			2												16			16	1	16	1
Montana	1									1	12			13	3		1				2			6	5	51		2	53	40	59	45
Nebraska	2									2	12			14	8		2	1			2			13	14	83	1	2	86	60	99	74
Nevada																														2		2
New Mexico			1				1			2	9			11	17	2	10	7	1	3	7			47	29	86	1	1	88	61	135	90
North Dakota											2			2	4						5			9	1	6			6	6	15	7
Ohio											1			1				1			2		6	9	5	25			25	20	34	25
Oklahoma	6	1	1	4	1		2		1	16	57			73	62	8	11	29	1	1	34	1	3	150	117	553			553	491	703	608
Pennsylvania																									1	2			2		2	1
South Dakota											1			1												3			3		3	
Tennessee																																6
Texas	39	9	5	19	1	1	7		1	82	331		5	418	399	52	64	120	8	14	79	5	18	759	752	2,905	6	156	3067	2836	3826	3588
Dist. 1 S. Central	5	2					1			8	34			42	15	4	1	1		1	3		1	26	30	240		6	246	168	272	198
Dist. 2 Middle Gulf		2	1	1						4	22			26	18	15	9	6			8	3	8	67	79	201	1	14	216	187	283	266
Dist. 3 Upper Gulf	2	3		6	1		1		1	14	38		5	57	23	16	7	43	5	7	3	2	5	111	83	234		20	254	209	365	292
Dist. 4 L. Gulf-S.W.	7	1	4							12	21			36	28	10	24	11	2	3	5		3	86	106	287	3	11	301	296	387	402
Dist. 5 E. Central		1					1			2	12			14	3	2					1			6	20	90		2	92	118	98	138
Dist. 6 Northeast											9			9	5	2	1	7			2			17	20	95		2	97	69	114	89
Dist. 7-B N. Cent.	12			3						15	69			84	126	2	12	7	1	2	4			154	176	694		9	703	756	857	932
Dist. 7-C W. Cent.	6			2		1	2			11	27			38	55		3	7		1	14			80	61	284		3	287	231	367	292
Dist. 8 West	2			2			2			6	38			44	45	1	1	17			26		1	91	74	301	1	4	306	290	397	364
Dist. 9 North	5			5						10	58			68	81		5	21			13			120	98	459	1	81	541	484	661	582
Dist. 10 Panhandle																	1							1	5	20		4	24	28	25	33
Utah											6			6							1			1	2	38			38	19	39	21
West Virginia															1									1	2	3			3	2	4	4
Wyoming			1							1	16			17	3	2	2	5			2			14	26	90		2	92	96	106	122
Total U.S.	71	10	14	26	2	1	16		2	142	737		8	887	734	90	118	228	13	28	222	6	33	1472	1433	6387	11	201	6599	6386	8071	7819

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IGHTS AND SAFE LOADS...

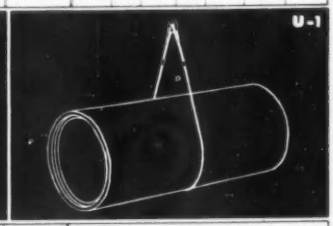
DIMENSIONS DIAM. IN INCHES	TUCK LENGTH INCHES	WEIGHT IN POUNDS A FOOT LENGTH	EACH ADDITIONAL FOOT	FITTING SIZES NONE	SAFE LOADS IN POUNDS STRAIGHT PULL	BASKET HITCH	45°	60°	90°
3		0.8	0.08		650	1,300	1,100	900	650
6½		1.8	1.8		1,500	3,000	2,600	2,100	1,500
8		3.0	3.0	SEE	2,600	5,200	4,500	3,600	2,600
9½		4.8	4.5	U-1-T TABLE	4,000	8,000	6,900	5,600	4,000
11½		7.4	7.0	BELOW	6,000	12,000	10,500	8,500	6,000
14		10.0	9.2		7,800	15,600	13,500	11,000	7,800
15		13.2	12		10,000	20,000	17,300	14,100	10,000
18		21.6	18		15,000	30,000	26,000	21,000	15,000
9½	24	35.0	27		22,000	44,000	38,000	31,000	22,000

U

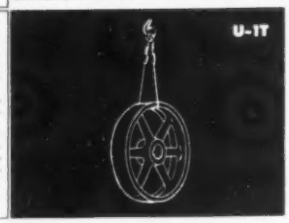
Eye Splices

STANDARD EYE SIZES FOR U-1 TUFFY SLINGS

¼	Tuffy Sling	4" eye
⅜	Tuffy Sling	6" eye
½	Tuffy Sling	8" eye
⅝	Tuffy Sling	9" eye
¾	Tuffy Sling	9" eye
⅞	Tuffy Sling	12" eye
1	Tuffy Sling	12" eye
1¼	Tuffy Sling	15" eye
1½	Tuffy Sling	18" eye



TYPE U-1-T



U-1T DIMENSIONS

DIAM. IN INCHES	MINIMUM LENGTH FEET	TUCK LENGTH INCHES	WEIGHT IN POUNDS A SLING INCL. FITTINGS	EACH ADDITIONAL FOOT	SLIP THRU THIMBLES THD REQ'D Code No.	SAFE LOADS IN POUNDS STRAIGHT PULL	BASKET HITCH	45°	60°	90°
⅜	3	8	6	0.30	U-1	2,600	5,200	4,500	3,600	2,600
½	4	9	9	0.45	U-1	4,000	8,000	6,900	5,600	4,000
⅝	4	11½	12	0.70	U-1	6,000	12,000	10,500	8,500	6,000
¾	5½	14	17	0.92	U-1	7,800	15,600	13,500	11,000	7,800
1	6	15	20	1.2	U-1	10,000	20,000	17,300	14,100	10,000
1¼	7	18	34	1.8	U-1	15,000	30,000	26,000	21,000	15,000
1½	8	24	51	2.7	U-1	22,000	44,000	38,000	31,000	22,000

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*Title*_____ *Company*_____

*Address*_____

*City*_____ *State*_____

WHO U. S. Discoveries in September WHERE

CALIFORNIA—NEW OIL FIELDS

Kern County. General Petroleum Corp.'s Graham 42-9, SE NE NW 9-30s-29e, pumped 196 barrels from Lower Jewett-Vedder sand, Miocene 5322-38 feet, 10/64-inch, 41.3-gravity, completed 9-7-52, TD 6395.

Los Angeles County. Union Oil Co.'s Horse-Meadows 2-47, SE NE 4-2n-16w, pumped 77 barrels from 4610-69 feet, 26-gravity, completed 7-21-52, TD 6696.

Santa Barbara County, Marshallia field. Union Oil Co.'s Jesus Maria 4, in 3-8n-35w, pumped 131 barrels oil and 68 barrels water from fractured shale 3409-3755 feet, 11.5-gravity, completed 9-19-52, TD 3893.

CALIFORNIA—NEW GAS FIELD

Sacramento County. Anthony J. Kennedy's Brown-Alrich 1, in 17-4n-4e, flowed 4 million from River Island sand 4198-4204 feet, ⅜-inch, completed 9-3-52, TD 4750.

COLORADO—NEW GAS FIELDS

La Plata County, South Red Mesa area. Southern Union Gas Co.'s Ute 1-A, C NE SW SW 13-32n-11w, flowed 2.8 million from Point Lookout sand, Upper Cretaceous 5495-5840 feet, completed 9-4-52, TD 5850.

Logan County, Frenchman's Creek area. F. Kirk Johnson, Dunn & Boreing et al's State 1, SE SE NE 31-8n-50w, flowed 13 million from Dakota "J" sand, Cretaceous 4666-72 feet, open, completed 9-5-52, TD 4790.

ILLINOIS—NEW OIL FIELDS

Clark County, Oak Point field. Joe Reznik's Kipler 1, SW SE 29-9n-14w, pumped 8 barrels oil and 40 barrels water from Carper sand, Mississippian 2222-2348 feet, completed 9-30-52, TD 2595.

Edwards County, Ellery, East field. Herndon Drilling Co.'s B. Curtis 1, SE SE SW 27-2s-10e, pumped 85 barrels oil and 5 barrels water from Lower O'Hara lime, Mississippian 3234-40 feet, completed 9-16-52, TD 3362.

Marion County, Junction City, South field. S. E. Mercer's Gibson 1, SW NE SE 32-2n-1e, pumped 6 barrels oil and 1 barrel water from Petro sand, Mississippian 686-94 feet, completed 9-23-52, TD 705.

White County, Sumpter, North field. E. A. Obering's D. Morrill 1, NW SE SW 21-4s-9e, pumped 150 barrels oil and 50 barrels water from Aux Vases sand, Mississippian 3181-86 feet, completed 9-30-52, TD 3188.

ILLINOIS—NEW OIL PAYS

Richland County, Clay City Consolidated field. Murvin & Steber's Wheeler 2, NE NE NE 24-4n-9e, pumped 14 barrels oil and 10 barrels water from Waltersburg sand, Mississippian 2174-80 feet, completed 9-16-52, TD 2598.

White County, New Harmony Consolidated field. Superior Oil Co.'s H. C. Ford "C" 17, C SW SE 27-4s-14w, pumped 20 barrels oil and 10 barrels water from Salem lime, Mississippian 3753-3808 feet, completed 9-30-52, TD 7682.

ILLINOIS—OIL FIELD EXTENSIONS

Christian County, Assumption, South field. Howard Cooper's Ken. Long 2, SE NW SE 22-12n-1e, 1-mile south extension, pumped 9 barrels from Devonian lime, Devonian 2624-44 feet, completed 9-23-52, TD 2645.

Hamilton County, Bungay Consolidated field. Ben Nation Oil Co.'s S. I. Endicott 1, SE SE NW 29-4s-7e, ¾-mile extension, pumped 17 barrels oil and 56 barrels water from McClosky lime, Mississippian 3501-06 feet, completed 9-9-52, TD 3531.

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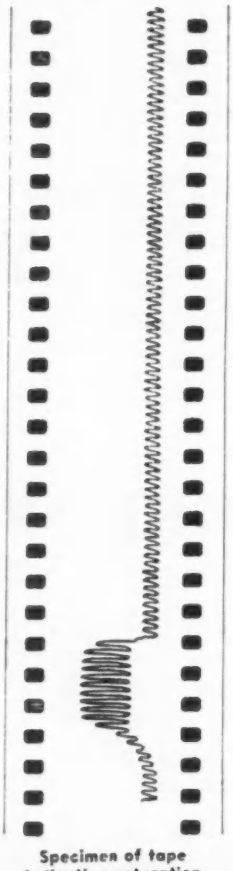

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ILLINOIS—NEW GAS FIELD

Saline County, Harrisburg field. R. Halbert's B. Harris 1, SW SW 34-8s-6e, flowed 4.7 million from Tar Springs sand, Mississippian 2080-90 feet, completed 9-30-52, TD 2194.

INDIANA—NEW OIL FIELDS

Gibson County. George & Wrather Oil Co.'s John Deiss 1, SE NW SE 24-3s-10w, pumped 8 barrels from Cypress lime, Mississippian 1664-70 feet, TD 1670.

Vigo County, Riley, South field. B. L. Fillingame's Bressett Grocery Co., Inc. 1, NW NW NW swabbed 100 barrels from Devonian lime, Mississippian 1704-11 feet, TD 1911.

INDIANA—OIL FIELD EXTENSIONS

Gibson County, Owensville, East field. Ryan Oil Co.'s Yeager-Plass Comm. 1, SW NE SW 20-3s-11w, swabbed 17 barrels oil and 50 barrels water from Waltersburg sand 1759-65 feet, TD 1765.

Owensville, South field. John Buchman-CE O'Neal-Aubrey & Tennant's Barnett-Witherspoon 1, NW NW NW 19-3s-11w, ¾-mile extension, swabbed 138 barrels from O'Hara lime, Mississippian 2627-33 feet, TD 2633.

INDIANA—NEW GAS FIELD

Sullivan County. Ottinger & Burgin's Hayden & Payne 1, SW NW NW 5-8n-9w, flowed 0.3 million, TD 467.

KANSAS—NEW OIL FIELDS

Butler County. K. T. Wiedemann's Lucas 1, SW SW SE 3-27s-7e, pumped 20 barrels from Bartlesville sand, Pennsylvanian 2709-32 feet, TD 2732.

Cowley County. Helmerich & Payne's Wright "F" 1, NE NW SE 35-33s-3e, flowed 443 barrels from Bartlesville sand, Pennsylvanian 3335-46 feet, TD 3346.

Ellis County, Antonio Townsite, East field. Petroleum, Inc.'s Wilson "B" 1, SE NE NE 1-15s-19w, pumped 83 barrels from Lansing lime, Pennsylvanian 3344-3346 feet, TD 3675.

Unnamed field. Imperial Drilling Co.'s Raynesford 1, SW SW NW 17-13s-20w, pumped 132 barrels from Conglomerate 3871-85 feet, TD 3885.

Finney County. C. R. A. & Hawley's Stewart "A" 1, NE SW NW 6-23s-30w, pumped 24 barrels from St. Genevieve 4732-46 feet, TD 4999.

Gove County, Lundgren, South field. Wycoff & Williams' Lundgren 1, NE NE SW 31-14s-29w, pumped 236 barrels from Mississippi lime, Mississippian 4277-83 feet, TD 4332.

Graham County. Murfin Drilling Co.'s Schnebly 1, SE SE SE 8-8s-22w, pumped 214 barrels from Lansing lime, Pennsylvanian 3507-12 feet, TD 3721.

Marion County. Aladdin Petroleum Co.'s Burton 1, SE SE NW 12-22s-3e, pumped 75 barrels from Mississippi lime, Mississippian 2474-83 feet, TD 2496.

Pawnee County. Musgrove Petroleum Corp.'s Phinney 1, SW SW NE 34-21s-16w, potentialed 3000 barrels from Arbuckle lime, Ordovician 3848-54 feet, TD 3854.

Stafford County, Bunselmeyer field. Anschutz Drilling Co.'s Bunselmeyer 1, NE NE NE 2-22s-13w, pumped 467 barrels from Arbuckle lime, Ordovician 3668-76 feet, TD 3750.

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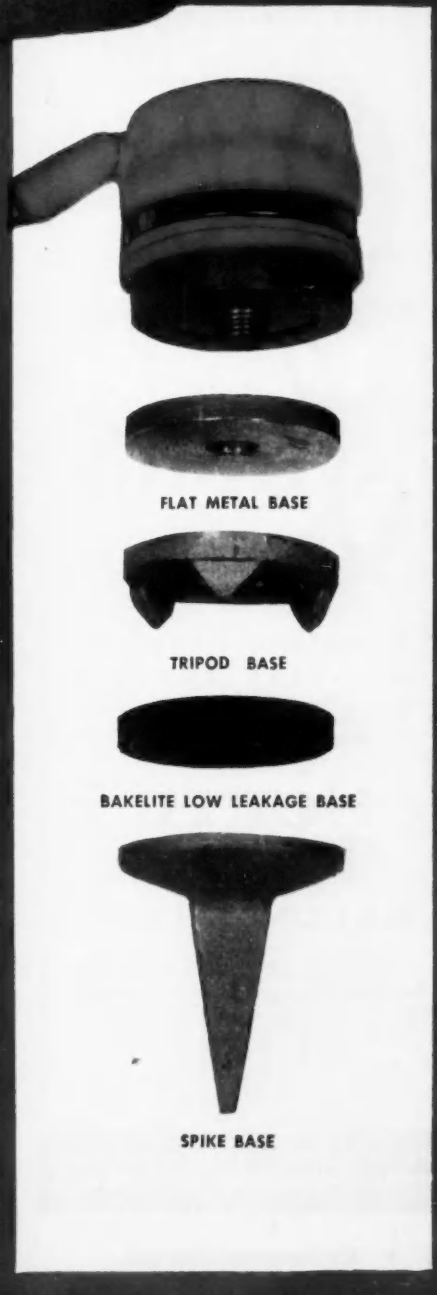

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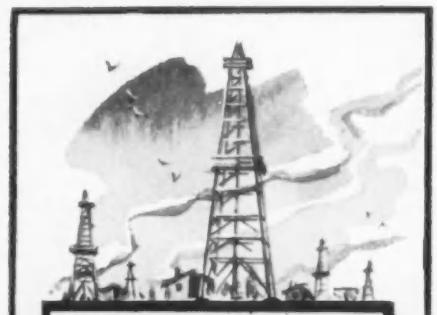

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KANSAS—NEW GAS FIELD

Meade County. Columbian Fuel Co.'s Stevens 1, C NE NE 32-32s-30w, flowed 8.8 million from Marmaton lime, Pennsylvanian 5560-97 feet, open, TD 6000.

KENTUCKY—NEW OIL FIELD

Union County. Dobbs Drilling-Fred Meyer Jr.'s Arch McNeely 1, in 3-P-20, pumped 150 barrels from Palestine sand, Mississippian 1488-1506 feet, TD 1506.

NORTH LOUISIANA—NEW OIL FIELD

Catahoula Parish, Pool Lake, West field. Glasscock Drilling Co. & W. L. Baker Co.'s Gillis Heirs Estate 1, C SE SE 17-8n-7e, flowed 134 barrels from Wilcox sand, Eocene 4536-53 feet, 10/64-inch, 40-gravity, completed 9-6-52, TD 6222.

NORTH LOUISIANA—OIL FIELD EXTENSION

Concordia Parish, Esperance Point field. Sinclair Oil and Gas Co.'s Hogue-Esperance 2, in 8-5n-9e, 1-mile southwest extension, flowed 353 barrels from Campbell sand, Eocene 6362-65 feet, 10/64-inch, 42.8-gravity, completed 9-8-52, TD 7005.

SOUTH LOUISIANA—NEW OIL FIELDS

Lafourche Parish. The California Co.'s W. A. Jones Unit 1-1, in 3-17s-22e, flowed 171 barrels from 9461-74 feet, ⅛-inch 35-gravity, completed 9-18-52, TD 12,102.

West Baton Rouge Parish, Lobdell field. Circle Drilling Co.'s Catherine Sugar Corp. 1, in 37-7s-11e, flowed 322 barrels from 9313-30 feet, 3/16-inch, 41-gravity, completed 9-16-52, TD 9500.

MISSISSIPPI—OIL FIELD EXTENSION

Adams County, LaGrange field. Barnett Serio's Mrs. C. L. Campbell 1, in 80-7n-2w, ½-mile southeast extension, pumped 88 barrels from Baker sand, Eocene 6241-48 feet, 41-2-gravity, completed 9-30-52, TD 6508.

MONTANA—NEW OIL FIELD

Dawson County. The Texas Co.'s NPRR-NCT 4 G-1, C SW SW 23-17n-53e, flowed 191 barrels from Ordovician 9908-48 feet, 20/64-inch, 43-gravity, completed 8-29-52, TD 10,148.

MICHIGAN—NEW OIL PAY

Ogemaw County, West Branch field. Ogma Development Co.'s Weiler 1, E½ SE SW 14-22n-1e, Ogemaw Township, flowed 40 barrels from Richfield lime, Denovian 4165-77 feet, TD 4239.

NEW MEXICO—OIL FIELD EXTENSION

Lea County, Dollarhide, West field. Elliott & Hall's Elliott Federal 1-R, in 31-24s-38e, 1¼-mile southwest extension, flowed 264 barrels from Clear Fork lime, Permian 6325-6447 feet, ½-inch, 40-gravity, completed 9-11-52, TD 6487.

NEW MEXICO—NEW GAS FIELD

San Juan County. Byrd Oil Corp's J. F. Hughes 1, SE NW NE 11-27n-9w, flowed 0.3 million from Pictured Cliffs 2138-2193 feet, completed 8-30-52, TD 2209.

NEBRASKA—NEW OIL FIELDS

Cheyenne County. Ohio Oil Co.'s F. Beyer 1, C SW SE SW 9-14n-50w, pumped 85 barrels from 1st Dakota sand, Cretaceous 4800-08 feet, completed 9-23-52, TD 5013.

Kimball County. Rogers Oil Co.'s Schrack 1, SE SE SE 34-14n-56w, pumped 80 barrels from Dakota "J" sand, Cretaceous 6409-22 feet, 42.5-gravity, TD 6640.

OKLAHOMA—NEW OIL FIELDS

Garfield County, Hunter, South field. Carter Oil Co.'s Carl E. Hoover 1, SW SW SW 20-24n-4w, flowed 340 barrels from Misener sand, Mississippian 6155-65 feet, 49.9-gravity, TD 6334.

Jackson County. Mid-Continent Petroleum Corp.'s Sue Richardson 1, SE SW SE 30-1n-19w, pumped 34 barrels from Strawn sand, Pennsylvanian 2396-2407 feet, 38-gravity, TD 2702.

Lincoln County, Fallis, Southwest field. Robert M. Jordan's Lopez 1, NW NW SW 6-14n-2e, flowed 30 barrels from Upper Cleveland sand, Pennsylvanian 3940-60 feet, ⅜-inch, 37-gravity, TD 5479.

Noble County. Arrow Drilling Co.'s I. O. Patterson 1, NW SE NW 30-22n-1e, pumped 60 barrels from Mississippi lime, Mississippian 4761-75 feet, 42-gravity, TD 4775.

Oklahoma County. Mohawk Drilling Co.'s Bernstein 1, SE SE NW 19-14n-3w, pumped 20 barrels from Viola lime, Ordovician 6420-30 feet, TD 6738.

Payne County. W. H. Martgan's Gaines 1, NE SW NE 25-18n-1e, pumped 105 barrels oil and 15 barrels water from Lower Skinner said, Pennsylvanian 4334-44 feet, 35-gravity, TD 5022.

OKLAHOMA—NEW OIL PAYS

Carter County, Lone Grove, Northeast field. Sinclair's W. J. Brown 2, SE SW NW 20-4s-1e, pumped 94 barrels from Lane sand, Pennsylvanian 5698-5720 feet, 38-gravity, TD 10,035.

Stephens County, Beaver field. Gulf Coast Western Oil Co.-Johnson & Gill's Tit-Tah 1, SW SW NW 3-2n-8w, pumped 81 barrels oil and 15 barrels water from Upper Cisco sand, Pennsylvanian 6622-80 feet, 37-gravity, TD 7650.

Milroy field. Edwin L. Cox's Wilson 1, NE NE NW 15-2s-4w, flowed 192 barrels from Sycamore lime, Mississippian 4136-75 feet, ¾-inch 37-gravity, TD 4180.

Rainola field. Jones Oil Co.'s Furst 9, NE SE NW 16-1s-8w, pumped 2 barrels oil and 34 barrels water from Reagan sand, Cambrian 8490-8500 feet, 34-gravtiy, TD 8740.

OKLAHOMA—OIL FIELD EXTENSIONS

Pottawatomie County, St. Louis field. J. F. Smith's Federal Land Bank 1, SW SE NW 13-7n-3e, west extension, flowed 35 barrels from Earlsboro sand, Pennsylvanian 4002-19 feet, ¼-inch, TD 4635.

Stephens County, Marlow, West field. Gulf Oil Corp.'s J. J. Briscoe 1, SW NE NE 11-2n-8w, northwest extension, pumped 14 barrels oil and 12 barrels water from Pennsylvanian sand 6084-6102 and 6298-6314 feet, 45.1-gravity, TD 7749.

OKLAHOMA—NEW DISTILLATE PAY

Major County, Ringwod field. Julius Livingston's Coppock 1, NE NE SW 4-21n-11w, flowed 120 barrels distillate and 6 million from Cherokee sand, Mississippian 5710-78 feet, open, TD 7030.

OKLAHOMA—DISTILLATE FIELD EXTENSION

Oklahoma County, Oklahoma City, Southeast field. Magnolia Petroleum Co.'s C. R. Cauthorn 1, NW NW NW 34-11n-2w, ½-mile north extension, flowed 192

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barrels distillate and 32.8 million from Basal Pennsylvanian sand 6754-64 feet, open, TD 6875.

OKLAHOMA—NEW GAS FIELD

Beaver County, Mocane, Southwest field. Sinclair's Pearl Maple 1, C SW NE 25-5n-24ecm, flowed 0.9 million from Mississippi lime, Mississippian 6495-6548 feet, 3/16-inch, TD 6695.

OKLAHOMA—GAS FIELD EXTENSION

Harper County, Laverne, Southeast field. Sunray Oil Corp.'s Long 1, C SW NE 3-25n-25w, flowed 0.3 million from Morrow sand, TD 7311.

TEXAS DISTRICT 1—NEW OIL FIELDS

Atascosa County, Pruitt area. F. William Carr and Louis H. Haring's Victor W. Marsh 2, M. Vall Survey 44, flowed 14 barrels from Navarro sand, Upper Cretaceous 4855-4886 feet, ⅛-inch, 37-gravity, completed 8-16-52, TD 4986.

Unnamed field. Lone Star Production Co.'s Sarah E. Ferry 1-A, Thomas Orr Survey, Section 241, pumped 12 barrels oil and 129 barrels water from Carrizo sand, Eocene 2180-82 feet, 17.9-gravity, completed 8-16-52, TD 2263.

McMullen County. Phillips Petroleum Co.'s Mula J. T. Pearson Trustee 1, Section 29, H&OB RR Co. Survey, flowed 70 barrels oil and 8 barrels water from Lower Wilcox sand, Eocene 5276-82 feet, ¼-inch, completed 8-18-52, TD 6006.

Medina County. George Parker's George Parker fee 1, Section 22A, Block 3, pumped 3 barrels from Anacacho lime, Upper Cretaceous 1357-90 feet, 24.4-gravity, completed 7-26-52, TD 1345.

Wilson County. F. A. Marcel et al's J. P. Lorenz A-2, Morris May Survey 37, pumped 34 barrels oil and 4 barrels water from Poth sand, Eocene 3062-75 feet, 29-gravity, completed 8-28-52, TD 3078.

TEXAS DISTRICT 1—OIL FIELD EXTENSION

Atascosa County, Weigang field. Hankamer Investment Co.'s W. T. Hurt 1, Kindallis Bryan Survey, Abstract 69, Section 143, ⅔-mile southwest extension, pumped 67 barrels oil and 36 barrels water from Carrizo sand, Eocene 3771-73 feet, 23.5-gravity, completed 8-19-52, TD 3773.

TEXAS DISTRICT 1—NEW DISTILLATE FIELDS

Bee County. Bright & Schiff's R. L. & Neil Schoolfield 1, James G. Morrow Survey, flowed 136 barrels distillate and 2.9 million from Slick sand, Eocene 7840-7844 feet, open, completed 9-20-52, TD 8810.

McMullen County. Argo Oil Corp.'s Myla Baker Estate 1, Sealy & Morris Survey No. 1, flowed 61 barrels distillate and 2 million from Wilcox sand, Eocene 9155-9166 feet, open, 50.8-gravity, completed 8-9-52, TD 10,614.

TEXAS DISTRICT 2—NEW OIL PAY

Goliad County, Pochler field. F. William Carr's J. W. Riggs 1, Jacob Fifer Survey, ¾-mile from production, flowed 43 barrels oil and 14 barrels water from Pettus sand, Eocene 4902-07 feet, 10/64-inch, 46.9-gravity, completed 9-11-52, TD 8760.

TEXAS DISTRICT 2—NEW DISTILLATE FIELDS

Calhoun County. Western Natural Gas Co.'s State M-31976 Tract 83-1, flowed 14 barrels distillate and 0.4 million from 8374-84 feet, ¼-inch, completed 9-22-52, TD 9517.

Goliad County. Hickok & Reynolds Royalty Co. & W. L. Pickens' Mrs. Rudolph Martin Estate 1, A. Linville Survey, flowed 151 barrels distillate and 9 million from Yegua sand, Eocene 5447-64 feet, 5/16-inch, completed 8-1-52, TD 8850.

TEXAS DISTRICT 2—NEW GAS FIELD

Jackson County. Sam G. Harrison's Willie E. Boehm 1-B, John Davis Survey, flowed 15 million from Frio sand, Oligocene 6300-04 feet, open, completed 8-17-52, TD 6400.

TEXAS DISTRICT 3—NEW OIL FIELDS

Colorado County, Mustang Creek field. Southern Minerals Corp.'s W. Roy Wright 1, J. G. Mahon Survey No. 12, flowed 191 barrels from Wilcox sand, Eocene 8980-9005 feet, 13/64-inch, 31-gravity, completed 9-18-52, TD 9005.

Grimes County. J. M. West's Olla Heath Garrett 2, A. B. Dodson Survey, flowed 30 barrels from Buda lime, Lower Cretaceous, 9354-70 feet, ½-inch, completed 7-15-52, TD 9370.

TEXAS DISTRICT 3—NEW OIL PAYS

Hardin County, South Hampton field. Kirby Petroleum Co.'s J. E. Wheat, et al 1, Fountain Simmons Survey, flowed

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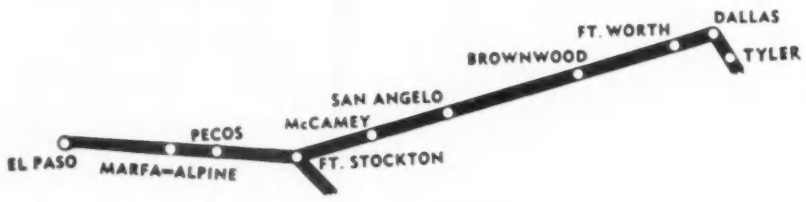

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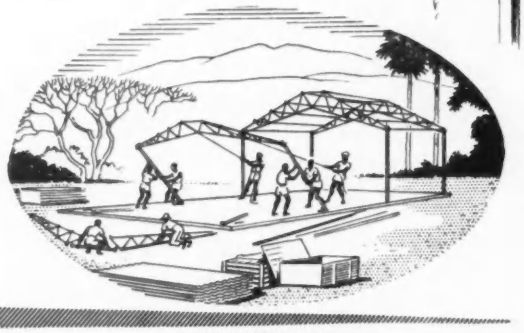
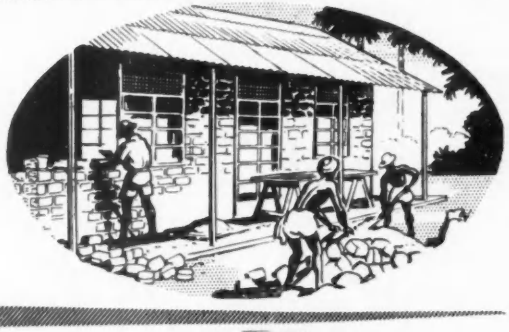


(1) *Here you see an upright of the 'Arcon' framework being raised into position. It takes little more than seven hours for seven unskilled men to assemble a 3-bay unit.*



(2) *Once the roofing is fixed, the walls can be constructed from inexpensive local materials — in this case unfired brick.*

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122 barrels from Yegua sand, Eocene 7650-53 feet, 14/64-inch, 36-gravity, completed 9-52, TD 8515.

Jefferson County, Nome field. Sun Oil Co.'s Estate of Ed Paggi et al 5, J. W. Kirby Heirs Survey, flowed 161 barrels from Marginulina sand, Oligocene 7423-25 feet, ⅛-inch, 47.8-gravity, completed 9-19-52, TD 8000.

Liberty County, Esperson Dome field. General Crude Oil Co.'s Esperson-Moore's Bluff A-70, GC&SF RR Co. Survey No. 24 flowed 94 barrels from 4th Frio sand, Oligocene 4408-10 feet, ⅛-inch, 27.3-gravity, completed 9-12-52, TD 5127.

South Liberty field. Floyd L. Karsten's E. W. Pickett C-1, Liberty Town Tract East League, Outer Block 50, Liberty Townsite, flowed 32 barrels from Frio sand, Oligocene 9856-94 feet, 10/64-inch, 35.4-gravity, completed 9-17-52, TD 10,992.

Matagorda County, Wilson Creek field. Phillips Petroleum Co.'s Stoddard 3, G. B. M. Cotton-Chris. G. Cox-J. C. Keller Survey, flowed 394 barrels from Frio sand, Oligocene 11,229-239 feet, 10/64-inch, 55.2-gravity, completed 9-23-52, TD 13,480.

Wharton County, Boling field. Michel T. Halbouty's J. B. Gary Estate et al "A" 5-A, flowed 154 barrels from Frio sand, Oligocene 6746-54 feet, 8/64-inch, 26.5-gravity, completed 9-13-52, TD 6838.

TEXAS DISTRICT 3—OIL FIELD EXTENSION

Chambers County, Fishers Reef field. The Texas Co.'s State Tract 9-12-C-2, Trinity Bay, ½-mile northeast extension, flowed 133 barrels from Hackberry sand, Oligocene 8962-66 feet, 7/64-inch, 34.4 gravity, completed 9-6-52, TD 9210.

TEXAS DISTRICT 3—NEW DISTILLATE FIELDS

Chambers County, Robinson Lake, East field. Standard Oil Co. of Texas' Alice Jackson White 1, James Jackson Survey 14, flowed 1288 barrels distillate and 25.8 million from Frio sand, Oligocene 10,346-357 feet, open, 58-gravity, completed 9-52, TD 11,811.

Harris County. N. B. Hunt's Leon H. Curtin 1, George Ross Survey, flowed 119 barrels distillate and 40 million from Frio sand, Oligocene 5452-62 feet, open, 50.2-gravity, TD 8350.

Liberty County. Floyd L. Karsten's Gorgan Mfg. Co. C-1, I&GN RR Co. Survey, Section 15, flowed 160 barrels distillate and 4 million from Wilcox sand, Eocene 8826-33 feet, 8/64-inch, TD 9900.

TEXAS DISTRICT 3—NEW DISTILLATE PAY

San Jacinto County, Cold Springs field. Commercial Petroleum & Transport Co.'s Foster Lumber Co. "A" 2-A, George Taylor Survey, flowed 200 barrels distillate and 1.8 million from Wilcox sand, Eocene 10,942-975 feet, open, 52-gravity, TD 13,113.

TEXAS DISTRICT 3—GAS FIELD EXTENSION

Wharton County, West Bernard field. Tidewater Associate Oil Co.'s Sallie Westmoreland 1, M. Muldoon Survey, east extension, flowed 35 million from clodine sand, Eocene 7083-97 feet, 9/64-inch, completed 9-14-52, TD 7776.

TEXAS DISTRICT 4—NEW OIL FIELDS

Hidalgo County, Santa Anita field. Taylor Oil & Gas Co.'s A. A. McAllen 3, Santa Anita Grant, flowed 154 barrels from Frio-Vicksburg sand, Oligocene 6990-93 feet, ⅛-inch, completed 9-29-52, TD 10,890.

Kleberg County, Kingsville field. Ritchie & Mumme's M. J. Kivlin et al 1, Kleberg Town & Improvement Co., Lot 8, Section 39, pumped 88 barrels oil and 44 barrels water from Lagarto sand, Pliocene 2114-19 feet, 21-gravity, completed 9-21-52, TD 2976.

San Patricio County. Jake L. Hamon's Beulah Hodges "B" 1, Victoriano Jurez Survey, Tract 3-A, flowed 73 barrels from Vicksburg sand, Oligocene 4917-25 feet, ⅛-inch, 30.3-gravity, completed 9-14-52, TD 5025.

Unnamed field. Phillips & Renwar Oil Corp.'s Hogg Estate-Margaret Wells Hogg et al 2, John Robinson Survey, flowed 45 barrels from Frio sand, Oligocene 8006-08 feet, ⅛-inch, 34.6-gravity, completed 9-6-52, TD 8505.

Starr County. Cunningham-Gunn-Allen's Cornelio Alvarez 1, Porcion 72, Share 38, pumped 13 barrels from Frio sand, Oligocene 716-21 feet, 22.7-gravity, completed 9-19-52, TD 721.

Unnamed field. Sun Oil Co. & George H. Coates' A. Ramirez C-2, "Agua Nueva de Abajo"-Jim Hogg Co. & "Las Comitas"-Starr Co. Grants, flowed 10 barrels from Hockley J-3 sand, Eocene 4834-37 feet, 5/32-inch, 49.7-gravity, completed 9-28-52, TD 5105.

Webb County, Gutierrez field. Bright & Schiff's J. O. Walker 1-A, Mrs. T. E. Puckett 770, pumped 90 barrels from Rosenberg sand, Oligocene 1678-90 feet, 24.7-gravity, completed 9-26-52, TD 1690.

TEXAS DISTRICT 4—NEW DISTILLATE FIELD

San Patricio County. Arnold O. Morgan's J. B. Hardwicke B-1, Pat Fitzsimmons Survey, Welder & Odem Subdivision, Block 41, flowed 84 barrels distillate and 1 million from Frio sand, Oligocene 6876-92 feet, 8/64-inch, 52 gravity, completed 8-29-52, TD 8513.

TEXAS DISTRICT 4—NEW GAS FIELDS

Aransas County. Western Natural Gas Co.'s St. Charles Bay State Tract 373-1, flowed 21 million from Frio "J" sand, Oligocene 8884-97 feet, open, completed 8-27-52, TD 10,727.

Nueces County. Alaska Steamship Co. & Newman Bros. Drilling Co.'s Hylton 1, Block 4, J. D. Herrera Survey, Wade Riverside Subdivision, flowed 1.2 million from Catahoula sand, Oligocene 3887-90 feet, 5/16-inch, completed 8-19-52, TD 7850.

Unnamed field. Phillips' Clara Driscoll Estate A-1, E. Villareal & W. S. McGregor Surveys 582 & 583, fllowed 3 million from Heterostegina sand, Oligocene 4833-40 feet, open, completed 9-19-52, TD 9000.

Webb County. E. J. Pearl & Ralph Rowden's Mabel Adami 1, Section 27, Share 3, flowed 10 million from Yegua sand,

Eocene 1357-58 feet, open, completed 5-28-52, TD 1534.

TEXAS DISTRICT 5—OIL FIELD EXTENSION

Grayson County, Big Mineral field. Cox Drilling Co.'s Bailey-Talley Unit 1, M. K. Snell Survey, 1-mile northeast extension, pumped 110 barrels from Strawn sand, Pennsylvanian 5297-5305 feet, 41-gravity, completed 9-22-52, TD 5995.

TEXAS DISTRICT 5—NEW DISTILLATE FIELD

Freestone County. Humble Oil and Refining Co.'s Fred Marberry et al 1, S. P. Flint Survey, flowed 6 barrels distillate and 5 million from Rodessa lime, Lower Cretaceous 6544-60 feet, open, completed 9-15-52, TD 13,595.

TEXAS DISTRICT 7-C—NEW OIL FIELDS

Coke County. Southwest Natural Production Co.'s Pallie Phelan 1, D. H. & J. W. Von Rosenburg Survey No. 6, flowed 326 barrels from Upper Strawn sand, Pennsylvanian 5886-5975 feet, 21/64-inch, 46-gravity, completed 9-18-52, TD 6411.

Irion County. B. F. Jones & Kenneth Lyons' J. W. Fields 1, John Dunman Survey No. 1802, pumped 32 barrels from San Andres lime, Permian 432-38 and 446-52 feet, 27-gravity, completed 9-15-52, TD 772.

Runnels County. Mar-Tex Realization Corp. and Edward Lee's E. F. Bryan 1, William Smith Survey, Block 599, flowed 247 barrels from Goen lime, Pennsylvanian 4421-27 feet, 16/64-inch, 38.4-gravity, completed 9-30-52, TD 4427.

Unnamed field. Rowan Drilling Co.'s C. H. Ashton 1, H&GN Survey, Abstract 282, flowed 122 barrels from Goen lime, Pennsylvanian 4525-45 feet, 16/64-inch, 38.4-gravity, completed 9-28-52, TD 4810.

Unnamed field. Sojourner Drilling Co.'s William Ashton 1, Section 150, ETRR Survey, pumped 32 barrels oil and 5 barrels water from Serratt sand, Pennsylvanian 2380-90 feet, 46-gravity, completed 9-5-52, TD 2390.

Unnamed field. Thomas D. Hurphrey's D. O. Lee 1, Joseph Farwell Survey No. 313, flowed 160 barrels from Caddo lime, Pennsylvanian 5108-15 feet, 11/64-inch, 40.1-gravity, completed 9-9-52, TD 5115.

TEXAS DISTRICT 7-C—NEW OIL PAYS

Runnels County, Poe-Goen field. Humble Oil and Refining Co.'s G. W. Poe 3, CTRR Survey No. 71, flowed 145 barrels from Canyon Reef sand, Pennsylvanian 2996-3008 feet, 20/64-inch, 43.8-gravity, completed 9-22-52, TD 4513.

Tom Green County, Harriett field. Humble's Mary B. Hall "B" 1, Section 23, Washington County RR Survey, flowed 243 barrels from Palo Pinto lime, Pennsylvanian 4408-13 feet, 20/64-inch, 41.3-gravity, completed 9-3-52, TD 4964.

TEXAS DISTRICT 7-C—OIL FIELD EXTENSIONS

Reagan County, Driver-Spraberry field. Sinclair's Watson Vaughn 1, Section 47, Block 37, T&P Survey, 4-mile south

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extension, flowed 132 barrels from Spraberry sand, Permian 7597-7638 feet, open, 37.3-gravity, completed 8-30-52, TD 7685.

Upton County, Wilshire-Ellenburger field. Wilshire Oil Co., Inc.'s McElroy Ranch Co. 14-117, Section 117, Block D, CCSD&RGNG Survey, 1-mile northeast extension, flowed 713 barrels from Ellenburger lime, Ordovician 12,322-391 feet, ¾-inch, 54.8-gravity, completed 9-21-52, TD 12,391.

TEXAS DISTRICT 7-C—NEW GAS PAY

Runnels County, Crews, South field. E. K. & E. M. Burt & Edgar Davis Drilling Co.'s J. H. Jones 1, Section 1, A. Losoya Survey 515, ½-mile southeast of production, flowed 27.5 million from Fry sand 3621-26 feet, open, completed 9-19-52, TD 4217.

TEXAS DISTRICT 8—NEW OIL FIELDS

Ector County. Herman Brown's David Fasken 1, Section 17, Block 42, G&MMB&A Survey, flowed 768 barrels from Upper Wolfcamp lime, Permian 8650-64 feet, ⅜-inch, 44-gravity, and flowed 231 barrels from Lower Wolfcamp lime, Permian 8750-60 feet, ⅜-inch, 45-gravity, completed 9-11-52, TD 10,314.

Gaines County. The Texas Co.'s R. A. Cox 1, Section 12, Block C-45, PSL Survey, pumped 51 barrels oil and 103 barrels water from Wolfcamp lime, Permian 9250-56 feet, 34-gravity, completed 9-16-52, TD 12,776.

TEXAS DISTRICT 8—NEW OIL PAYS

Andrews County, Midland Farms field. Anderson-Prichard Oil Corp.'s Fasken 24-1, Section 24, Block 42, G&MMB&A Survey, flowed 675 barrels from Ellenburger dolomite, Ordovician 12,672-702 feet, 24/64-inch, 49.8-gravity, completed 9-26-52, TD 12,795.

Howard County, Vincent field. Standard Oil Company of Texas' C. L. Jones 1-1, Section 59, Block 20, Lavaca Navigation Survey, flowed 243 barrels from San Andres lime, Permian 2890-2910 feet, ½-inch, 25.9-gravity, completed 9-11-52, TD 2936.

TEXAS DISTRICT 8—OIL FIELD EXTENSIONS

Howard County, Vealmoor, East field. Crane Oil Company of Texas & Newman Brothers Drilling Co.'s Hassie Clanton 1, Section 35, Block 32, T3N, T&P Survey, 1¼-mile east extension, flowed 82 barrels from Canyon Reef lime, Pennsylvanian 7989-8003 feet, ¼-inch, 43-gravity, completed 9-20-52, TD 8003.

Martin County, Howard-Glasscock field. Plymouth Oil Co.'s Morris 1, Section 7, Block 35, T&P Survey, 1½-mile southeast extension, pumped 38 barrels from Spraberry sand, Permian 7873-97 feet, 39.4-gravity, completed 8-30-52, TD 7946.

WYOMING—NEW GAS FIELD

Sweetwater County—Mountain Fuel Supply Co.'s Unit 1, NE NE SE 9-13n-100w, flowed 4.3 million from Basal Blair sand, Upper Cretaceous 7544-68 feet, completed 9-2-52, TD 7731.

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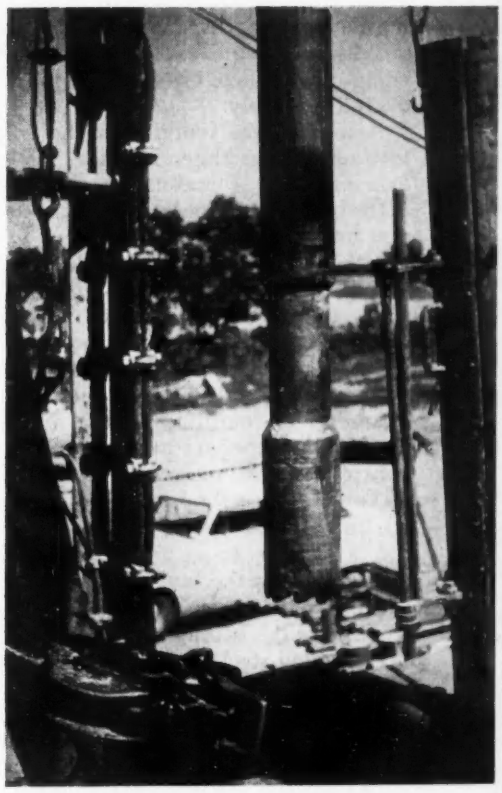
President K&G Oil Tool & Service, Inc., Houston



Assembled magnetic tool ready to run in hole. Ports and rotary shoe permit dislodging and washing fish for rapid recovery.

REMOVING BOTH small and large metal segments from well bores has become a relatively easy process with a new, improved magnetic fishing tool. Filling the gap left by conventional fishing equipment, these tools will recover minute particles which tend to float with pump action and larger, heavier pieces which cannot be pumped off bottom. An advantage of the tool is the speed in which an operation can be completed.

Magnetic fishing tools are not new to the industry. In an effort to provide an easy and sure means for removing metal from well bores, patent records reflect experimental work with magnetic fishing tools since the 1890's. Until recently, these tools depended either upon the electro or horseshoe magnet principle and design.

The end of World War II gave the magnetic tool designer another material—cobalt steel—which has proven invaluable for permanent magnetic equipment. With the advent of this product, plus other structural changes permitting rapid, pressurized mud flow through the tool, near perfection has been reached in magnetic tool design.

An early version of magnetic fishing tools was the housed horseshoe element run on a sand line. Although this equipment represented an important step in improved fishing technique, the process of running in on a wire line uncovered several disadvantages. First, it was not possible to provide a means for circulating drilling fluid to wash a fish for effective contact. Then, use of a rotary shoe offered no advantage since the wire line tool could not be rotated. In an instance where the fish was fully exposed and not imbedded, this tool worked quite effectively and could be run rapidly. However, it was believed highly desirable to have a method for washing and mechanically "stirring" the fish on bottom. In this light, research continued toward the development of a tool possessing magnetic force, the ability to circulate drilling fluid and a mechanical means of rolling and dislodging junk in the hole.

Electro-Magnet an Improvement

After extensive work with the original wire line magnet, operators then designed and built electro-magnetic units with a motor and pump fabricated within the body of the tool. The magnet was energized with a generator through a specially constructed cable permanently installed in a heavy-duty truck. In field practice, the unit offered certain advantage with its ability to circulate fluid and wash the fish; however, the expense of the unit—almost $50,000—was beyond the realm of decent economics. Even so, the 1¾-horse motor and small pump permitted the operator to circulate at 200 pounds per square inch to remove cuttings resting on top of the fish.

Although the electro-magnet unit represented a definite milestone in this specialized fishing technique, the operator was faced with several handicaps including high fabrication cost, slow transport of the heavy equipment, the ability to circulate limited volumes of drilling fluid and the inability to use shoes.

The presence of these conditions prompted designers to further investigate application of permanent magnets for suspension from drill pipe, tubing or rod strings.

Modern wire line operators discarded the horseshoe type magnet after extensive investigation of the field. It was found that the horseshoe magnet, which was employed in early tool design, offered certain disadvantages in the fact that the magnet had to be cased in non-magnetic housing. For this purpose, brass or other low

tensile strength, non-magnetic materials were required. The net result being a sacrifice of strength in the overall assembly.

Again, it was found that the conventional horseshoe magnet would lose magnetic force unless a keeper plate bridged the poles when the tool was not in use. A final handicap was the fact that the structural design of the horseshoe type instrument would allow for only a very limited number of water courses.

Use of cobalt steel for better controlling the field distribution of the magnet was found to be the answer for fishing tool requirements. The controlled field magnet concentrates all forces across the base or pole plate. In turn, it was found unnecessary to use a keeper to retain magnetic strength when the tool was not in use.

The modern tool, with the controlled field, is cased with 31-40 heat treated steel since the force within this type instrument will not dissipate through the case. Placement of a brass pole plate in the tool base across the air-gap serves as a protector for the upper magnets without shorting the poles.

Dissipation of magnetic forces within the modern tool does not occur unless the pole plate is removed and the tool completely disassembled.

Rotary Shoe and Water Courses

The modern magnetic fishing tool is designed to adapt several different rotary shoes including the spiral, mill type or flat bottom. The shoes are not intended for actually milling-up junk but they have been installed to permit the operator to mechanically agitate and loosen junk. Without the rotary shoe, there would be many instances where it would be nearly impossible to remove formation cuttings from above the fish or, in the case where a dropped drill string has shattered and embedded a bit, it would be difficult to loosen the fish for magnetic recovery.

Water courses surround the diameter of the tool's pole plate, hence it is possible to circulate drilling fluid at normal rates and pressures. The water course design permits circulating for long, interrupted periods with no damage to the tool.

The powerful controlled magnetic field, presence of a milling head, coupled with the ability to circulate large volumes of pressurized fluids, all reflect the advantages of the modern day magnetic tool.

Rugged Construction

Heat treated steel construction of the magnetic fishing tool permits running the instrument any place a bit will washdown in open or cased hole. Although the tool is durable and less subject to damage than the horseshoe magnet cased in softer metals, it is not designed to actually "make-hole", but this is not the purpose of the tool. Rugged in construction yet light in weight, these tools are delivered to problem locations by plane or car. Only the 11½-inch tool is carried on a small trailer.

These small metal fragments are readily retrievable with magnetic fishing tool.

The tools are made up in each joint size standardized by bit manufacturers. Under the circumstances, it is seldom necessary to use subs in making connections.

The large tool is capable of lifting at least one ton under perfect contact conditions. An example of the tool's strength is illustrated by one job where a broken 12¼-inch rock bit was removed in two runs. In another instance, an 18-inch rotary sprocket was recovered from a 30-inch hole with the nine-inch tool.

Temperature, pressure or other hole conditions have no influence on the tool's performance efficiency. Rigged for washing to bottom and circulating, even light formation bridging offers no serious problem.

Reviewing field operational history of the tool, which has been employed on more than 700 successful jobs, the chore of removing cones, sprockets, hand tools, retainers, chain, slips, bolts, keys etc. is a comparatively simple job with the powerful magnetic force available. If the operator has made no attempt to millup junk in the hole, the magnetic fishing operation is greatly simplified since there is a reduced danger of fragments being shoved back into the side of the hole. When the fish has been left undisturbed, it is just necessary to run the magnetic tool to bottom, rotate slowly to loosen it with the mill head, set-down for contact, and come out of the hole. The entire bottom hole operation seldom takes more than 15 to 20 minutes.

The success of diamond coring and drilling tools is unquestionable; however, the presence of just one small steel fragment in a well bore will seriously damage the diamond tool in just a matter of minutes. Here is one of the important uses of magnetic fishing tools, the removal of junk prior to running bottom hole diamond tools.

The danger of small steel fragments such as bit teeth is ever present since it is very difficult for the operator to "feel" such small objects with a conventional bit. In hard rock drilling operations, it is often necessary to run 70 or more rock bits prior to reaching the coring point. When the coring depth is reached, the operator has no assurance that the hole is void of bit teeth or other small metal objects. The fact that bit teeth may cleave off is no fault of the product since improper use of bits will often result in leaving teeth in the hole.

With this thought in mind, some operators are now using the magnetic tool for an "insurance run" before a diamond coring tool is made up on the string. This practice assures the operator clean hole conditions preparatory to diamond drilling or other bottom-hole operations.

Magnetic fishing tool application is not strictly limited to drilling operations. Since the tool is made in sizes ranging from 1¾ to 11½ inches outside diameter, a wide variety is provided to satisfy requirements for any fishing job. The smaller tool can be run on either .066 diameter wire line or a sucker rod string while the larger equipment is used on tubing and drill pipe. Production wise, the magnetic tool has seen service in recovering standing valves, swab cages, or damaged pump parts. In many cases, fish recovery by magnetic method eliminates the need for a tubing job.

Specialized Field

Although maintenance and field use of the magnetic fishing tool is comparatively simple, it has been found preferable to conduct magnetic fishing jobs under the supervision of trained personnel. The magnetic fishing tool operator must have sufficient experience to depend upon a "sixth sense" rather than the weight indicator since a majority of junk removed is too light to record any pickup on the indicator. Again, it is often a tendency for the inexperienced operator to run on the tool just because it is built with a rotary shoe. Even though the apparatus is constructed of rugged steel components, the practice of carrying too much weight on the shoe while rotating at rapid speeds will result in damage to the equipment.

Gas-Drilled Wells Yield More Oil

- **Greater productivity proven by 14-year case history.**
- **Dual drill pipe is a new development.**

By NORMAN C. WELLS
Consultant, Long Beach, Calif.

THE GRADUALLY expanding use of gas and air as drilling fluids is becoming an important development in the industry. To anyone who has attempted to beg, borrow or buy compressors for this purpose, any advance in this prolific field of drilling mechanics must be attributed to the ingenuity for which the drilling personnel is noted. The possibilities offer a solution to many types of problems in drilling that arise from, or cannot be solved by, the use of liquid drilling fluids or cable tools. Four types of applications have been used to date:

1. Drilling, testing and completing in a low pressure oil sand to obtain optimum production and depletion.
2. Drilling a fracture system to avoid plugging of the fractures penetrated.
3. Drilling porous gas sands to avoid contamination, lost circulation and cleaning out for production.
4. Drilling for surface pipe where extreme conditions exist that are conducive to lost circulation.

Other applications will be developed in the course of time. Speculatively, these might include:

1. Extreme running sand conditions that cannot be economically produced by other methods of completion.
2. Tight sands that are so badly impaired by conventional drilling fluids that they cannot be produced commercially.
3. Output wells for repressuring or water-flooding operations designed to reduce bypassing of these wells.

This latter application is suggested as offering great possibilities to enhance the achievement of maximum depletion of certain types of oil sands. This is accomplished by leaving the sand in the immediate vicinity of the bore hole in its virgin state. Reduction of pressure in the bore hole without any relatively reduced permeability around it will permit free migration of fluid towards it. Too, this migration can be better controlled for maximum ultimate depletion without fear of causing it to bypass the output wells in so doing. With output wells completed in this manner, improved control of reservoir performance should be possible.

The first application using gas to

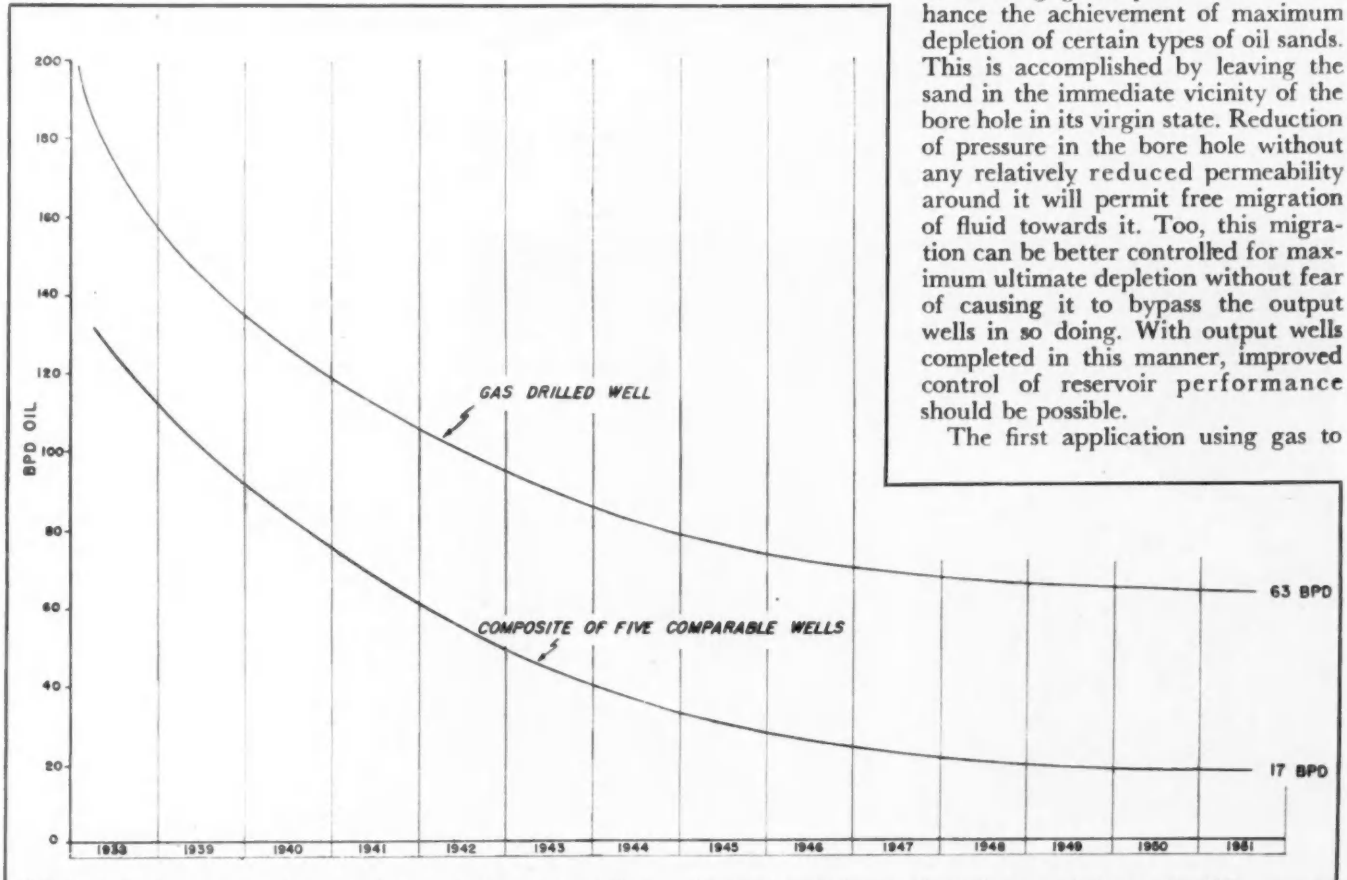


FIGURE 1. Decline curve and present daily production of gas drilled well (upper curve) and composite curve (lower) of five comparable wells. Cumulative production data: Average of five wells, 100 percent; highest comparable well, 114 percent; gas drilled well, 186 percent.

drill the zone of a low-pressure oil sand was probably that of a major oil company in 1938. Two wells were completed in the Brown zone in Signal Hill, Calif., using recirculated gas with a spray of oil injected into it. Other "pressure drilling," or "reduced pressure drilling," operations had involved the use of gas injected into a stream of oil to lighten it, or, as in Oklahoma City, largely relying upon the production from the zone to bring cuttings to the surface as drilling progressed. In the Signal Hill operation the gas was recirculated by means of compressors and the whole system was kept in the gas phase at all times. Gas oil ratios were in the order of 5000 to 7000 cubic feet per barrel of oil. Since one of these wells has produced with less than normal interruption for bailing since its completion, a review of the mechanics of drilling and completing it and a comparison of its production behavior to date is a matter of interest.

At that time, the industry was not aware of the damage to sand permeability of particle penetration. This type of damage will result with the use of any drilling fluid under a condition of unbalanced pressures where the pressure within the bore hole is greater than the formation fluid pressure. Some technicians have expressed the belief that the damage resulting from particle penetration is far greater than all other damaging effects combined, including that resulting from water infiltration. This effect is only now becoming fully recognized. However, some of the disadvantages of using conventional drilling fluids in an oil zone were well known at the time referred to and the use of gas as a drilling fluid was designed to eliminate them. The deleterious effect of fresh water in some sands was suspected but it was not known then exactly what was happening. The whole effect usually was attributed to surface tension and capillarity until the phenomena of hydration and swelling of clay particles became better known.

One fact was fully recognized, namely, that mud cake was difficult, expensive and time consuming to clean out. It was also known that the best cleaning methods left the sand face in such a condition that only a part of it was used in attempting to produce the total sand. In laminated sand beds this was considered to play a very important part in restricting both initial and ultimate production, since vertical permeability in such a sand is very low as compared to its horizontal permeability. Even in homogeneous sands, restricting the exits into the well bore would cause relatively high velocities as the fluid would travel towards these openings. In so doing, the fluid would transport particles through the interstices of the sand grains and clog the passageways. This clogging would become progressively worse as the entrance or "outlet of the funnel," to the well bore was approached. Bringing in such a well too rapidly might thus be compared to sounding a fire alarm in a theater followed by the resultant jamming of exits. Complete elimination of restricted flow in a sand would be the equivalent of a theater with no walls and restricted exits. In an attempt to build such a structure, gas was tried as a drilling medium to remove cuttings and to keep the bit cool.

Each of these particular wells was drilled to a little below 3800 feet, to the bottom of the Brown shale, in the conventional manner. A string of 8⅝-inch casing was cemented and tested for water shutoff. The mud then was changed to water and the rig converted for gas circulation. To accomplish this, cellar connections were changed over to consist of a master valve on the bottom and, above it, a bag type head, then a pressure drilling head with a square kelly. It was necessary to rent five portable steam driven compressors and to install a five-unit boiler plant to operate them. For trapping oil and cuttings out of the returning gas, two conventional traps were used with satisfactory results by merely installing four-inch outlets with water jets in the bottoms. These were switched back and forth for cleaning, using only one at a time.

Two float valves were installed in the bottom of the 3½-inch drill pipe to bleed off only the gas in the drill pipe for making connections. All gas bled off the system was carried from the standpipe up through a pipe alongside a derrick leg and blown into the air about 80 feet above the floor. Piping was designed to minimize the effect of sand blasting. Inspection upon disassembly showed no visible signs of cutting. Clean oil was used and flowed from the gas trap to a settling tank from which it overflowed into the suction tank and thence was pumped into the gas stream ahead of the standpipe. Conventional circulation was used, thus maintaining a minimum pressure of about 50 pounds per square inch on the pressure drilling head packing elements. A sampler for cuttings and meters on the gas assisted in testing as drilling proceeded.

FIGURE 2. View of tool joint for double string of drill pipe using 2½-inch EUE tubing inside 4-inch EUE tubing. Visible end plates welded on merely for pressure-testing purposes.

FIGURE 3. Double string tool joint made up to hand-tight position. Standoff shown is 5/16-inch. Pressure testing with air proved feasibility of simultaneous seal.

Production Records Compared

Figure 1 graphically tells the story of production. For the composite (lower) curve, five comparable conventional rotary-drilled wells that had stayed the cleanest were used. Their characteristics were much the same and one of them was completed only three months prior to the gas-drilled well. In plotting these curves, individual well test tank gauges were available for the first three years and the last two years. Cumulative production for the period Mar. 1, 1938 to Nov. 1, 1950 was, for the gas-drilled well, 186 percent of the average for the five conventionally drilled wells. Recent

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production for the individual wells is as follows:

	Gross	Net
Gas-drilled well	65 BPD	63 BPD
Comparable well A	20	20
" " B	27	15
" " C	22	21
" " D	15	15
" " E	15	14

In the initial production comparison, individual well gauges were not available and some misleading production estimates were somewhat discouraging. Fourteen years production history with more accurate information has borne out the success of the venture. Then too, the reasons for its comparative success are better understood, to the extent that it now appears that the method was too far advanced for the industry at that time.

The problem of trained personnel was a serious one. At the completion of the second well it was felt that the investment in equipment and specialized supervision could better be handled by a service company that would be kept continuously busy on this one type of drilling. At present, it appears that the availability of suitable portable compressors is the principle stumbling block.

Cost could equal or better that of a present day completion. The cost of the two operations described was equal to conventional operations. Any savings that could be made by more efficient methods of cleaning mud completions for production would be more than offset by the savings in using engine-driven compressors as against steam driven.

Individual well and reservoir performance as compared to the use of modern liquid drilling fluids must yet be determined. However, there appears to be every advantage in its favor for many types of zones. As for safety, the system easily can be made into a safe and clean one for any operation. Certainly, nothing approaching the danger of pulling a tester can be conceived in its normal operation.

The general attitude of the industry seems to be that of waiting for someone else to try it and get blown sky high. The fear that is still somewhat prevalent is, of course, unnecessary. Proper design and supervision by qualified personnel who are familiar with the details of handling gas and with conventional drilling are both essential. The rewards are rich and it is freely predicted that the method will very soon be in use on a large scale. To most of those who have attempted to use the method, the problem of obtaining suitable compressors in a reasonable time has been a baffling one. It would appear that some advanced planning and foresight, looking to the future, could overcome this. Certainly, the demand for unitized compressors is so great that an investment in them could never become much of a loss.

No description of these various applications would be complete without describing a new development that should materially enhance the use of gas or air as a drilling fluid. This is a double string of drill pipe. The design has been successfully worked out so that the two tubes, one inside the other, can be held together by means of webs. The threads on each tube have the same lead and are designed to make up concurrently. Figure 2 shows such a tool joint that was made up from 4-inch external upset tubing and 2½-inch external upset tubing. The cross-sectional area of the annulus is 5.83 square inches and that of the inner tube 4.70 square inches. This excludes the upset and the web, between tubes, which is not continuous. Circulation of air or gas would be directed down the annulus and up the inner tube. A cross-over would be used above the bit. A specially designed double kelly and double swivel with two flexible steel hoses would complete the drill string. The design has been well carried out and should be successful.

The advantages of this type of drill pipe would be many; not the least of which would be reduced compressor capacity requirements by at least one-half. This would reduce the investment, rigging and operating cost of the compressors to one-half the cost as against the cost of using conventional drill pipe.

In addition to this, there are certain mechanical advantages in making hole. Shale cuttings would not be plastered against the face of the sand, to be ground into it by the action of drill collars and tool joints. Also, it should enable the drilling of a more nearly true-to-bore hole, since there would be no tendency to form cavities. Also, as an advantage to the geologist, the obtaining of true samples of cuttings would be possible almost instantaneously.

The design of the double string has been perfected but its construction and operation have not as yet been exploited. Certainly, as the above described methods of drilling become more common its use will play an important part in them.

Not the least important part of the hookup was a valved manifold for controlling the operation of the pressure control equipment. This was located near the driller. The whole system was actually quite simple and safe to operate. Unitizing for portability could be accomplished to much better advantage. This, of course, would be particularly true of multi-cylinder engine-driven compressors now available. Operating within a reasonable distance of a high-pressure gas supply, such as a high-pressure well, a compressor plant or a high-pressure gas line would be a luxurious advantage.

A rock bit with side reamers gave very good performance. Totals of 793 feet and 888 feet of hole were made in these wells and the 7⅝-inch bits probably could have made all of each hole with one bit. Bearing and tooth wear were negligible when they were pulled after 450 feet of drilling. In fact, "drilling" is hardly the word as the bits seemed to be on bottom only while going through streaks of shale. Rate of penetration was arbitrarily kept down to 10 feet per hour. Gas pressures ranged from 250 to 500 psi with 30 psi on the trap. Each operation took about eight days. This time actually could have been materially reduced after gaining the experience and confidence of completing the first two wells without incident.

Formation tests were made by merely stopping oil injection, circulating for an hour and then taking gas and oil measurements. In the second well, cuttings were measured and found to equal 150 percent of the bit size hole volume. Before running the liner, the hole was filled with oil up to the shoe and one of the first oil electric logs was run in the hole.

Hole condition after completion was indicated when, after pumping for ten and one-half months, the second well's tubing stuck in the liner and in pulling it the whole liner came

About the Author

NORMAN C. WELLS, a mechanical and petroleum engineering consultant in Long Beach, Calif., received a degree in Mechanical Engineering at University of California in 1926. He is a member of Tau Beta Pi, engineering honor society. For the past 15 years, he has been active in drilling and production engineering and supervision, including related gas problems.

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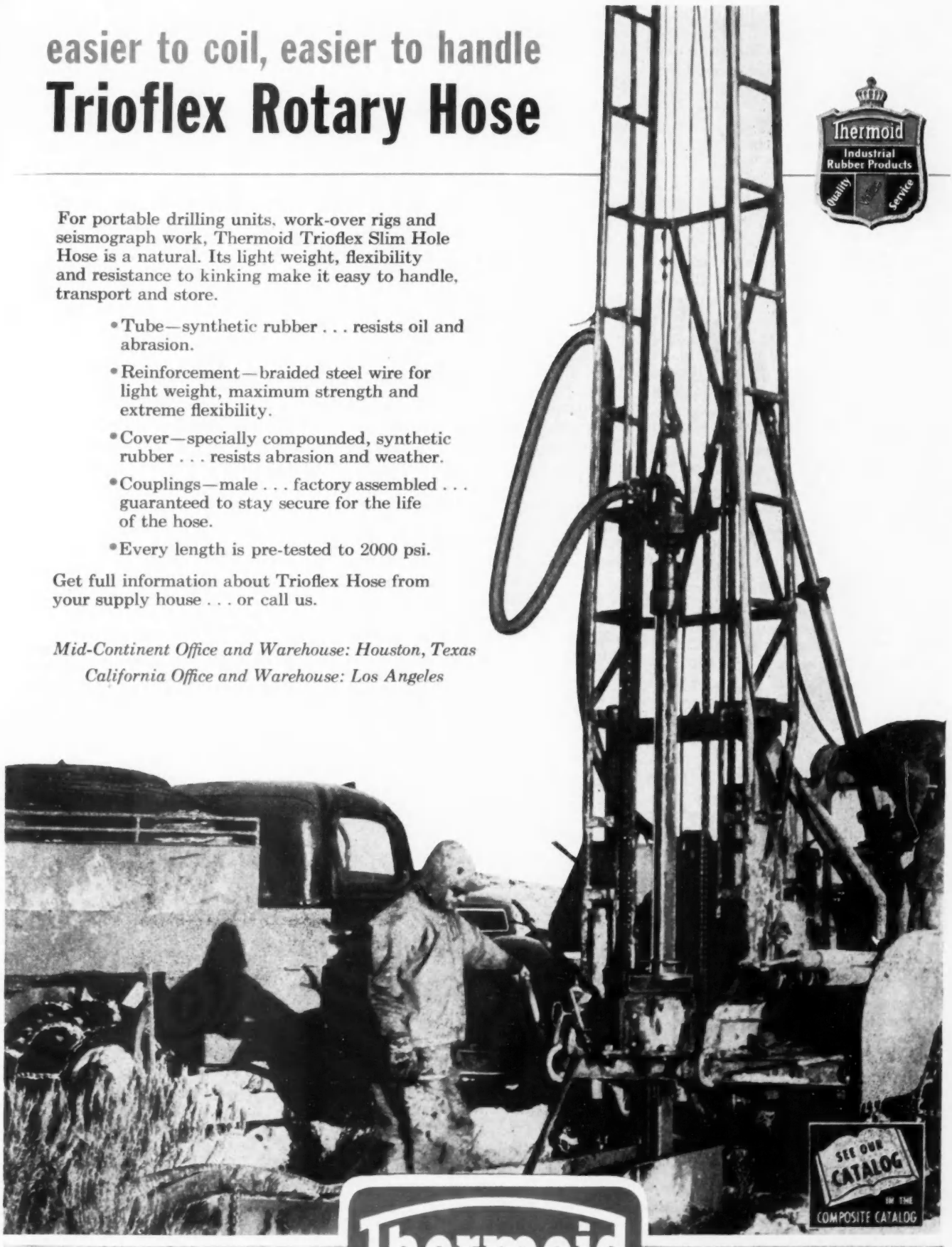

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out without the crew realizing it until it appeared at the surface. This well, incidentally, had to be abandoned some years later. It was structurally in a poor location. Each well was put right on production as a clean well and gave no trouble from sand as compared with other wells in the same area completed in the Brown Zone. Thorough blowing of the hole in a drilling operation of this sort was well described as taking the place of many years of intermittent bailing.

The first well, fortunately, has remained on production and is still producing as a very good, clean well. This has enabled a production comparison to be made over a substantial period of years as well as a comparison of sand trouble. The sand record is remarkably good, being almost nothing by comparison with neighboring wells in the same zone. Some bailing was done when tubing was pulled and amounted only to the following:

Placed on production Jan. 29, 1938
Sand bailed ..... Oct. 28, 1939—15 feet
Oct. 22, 1943—26 feet
Mar. 12, 1947—26 feet

Characteristics of a well completed in this manner as to its making sand can be attributed to two things. First, the entrance velocity into the bore hole is low for the rate of fluid production because all of the sand face is clean and free to produce. Second, the hole has been blown until an angle of repose is reached for each sand member and this is done at reduced pressure and without any plastering of filter cake to temporarily hold back sand entry. Large volumes of sand can be blown out in a very short time if it is desired to do so. For blowing sand grains out of the hole while drilling, a velocity of 25 feet per second was used in designing the system. It has been suggested, very correctly, that the entrained mist of oil in the gas materially helped to transport cuttings to the surface. Some quite large pieces of shale were brought to the surface.

Technique in San Juan Basin

In the San Juan Basin, more recently, gas is being used to drill an 800-foot section in 5000-foot gas wells. The operation is aided by gas produced during drilling. It is particularly notable in this operation that no oil is injected into the gas. With a dry bit, remarkable results are obtained. A bit which used to make 80 feet of hole is now reported to be making 300 to 400 feet. Penetration rates of 150 to 200 feet per day have been stepped up to as much as one foot per minute. Fishing, lost circulation and cleanout problems have been whipped by the method. The section drilled consists of alternating sands and shales.

In this operation gas was brought from a high pressure line and, after removing cuttings in a dust collector, burned in a flare at some distance from the rig. It appears that the input volume averaged roughly 2,000,000 cubic feet per day and the output around 3,000,000 cubic feet per day. Standard circulation was used with about 250 psi input pressure. More details are included in an article on the subject in the August, 1951 issue of World Oil.

Again in World Oil issues of September, 1951 and December, 1951, there are two articles describing the air drilling of the Spraberry sand in West Texas. The operator must be complimented for his faith in the method since, for his first venture, he had to rent 13 portable construction compressors for the job. He used both standard and reverse circulation. With reverse circulation, some trouble was encountered with cuttings balling up in the bit and drill collars; otherwise, the operation was successful.

The problem in the Spraberry sand is a very interesting one. The sand itself is a very impermeable one and production is obtained through the fracture system. If drilling fails to penetrate the fracture system, nitro or formation fracturing is resorted to. If this fails to establish communication, the well is a dry hole. In the primary cementing job, great care must be exercised not to plug the fractures below with cement. In one instance as drilling progressed below the shoe, a thin section of cement was cored. Naturally, this type of zone presents two major problems in drilling: lost circulation and plugging of the production passages.

Normal circulation pressure was 250 psi at a rate of 1,000,000 cubic feet per day. A tendency to plug would raise this pressure. It is believed that this plugging tendency can be eliminated or at least minimized. All in all, this is an extremely interesting application and some further efforts to eliminate the plugging should be made. Here, again, the operator has been seriously handicapped in the matter of obtaining suitable compressors. As in the case of the gas drilling first described, fighting cranky compressors is expensive, exasperating and time consuming.

Another application of air drilling is being employed in South Mountain, Calif. Here, a serious condition conducive to lost circulation exists at fairly shallow depth. Various methods were used to combat this, including cable tools. The latter method was time consuming and led to mechanical difficulties. Also, the hole could not be kept within less than eight degrees from vertical. With air drilling the hole is kept within three degrees of vertical.

For this operation, air is circulated at a rate of 4,400,000 cubic feet per day using standard circulation and a velocity of 90 feet per second. Again, some trouble was encountered with the cuttings balling up. However, drilling is proceeding satisfactorily. This is attested by the fact that total time from spudding to completion of cementing was from 30 to 36 hours as compared to 12 to 18 days with cable tools.

Five wells were drilled in this manner and more now are being drilled. Depths range from 780 feet to 1040 for setting surface pipe. Hole size is 12½-inch, in which 9⅝-inch surface casing is landed. Needless to say, the operation is being watched with a great deal of interest.

For drilling shot holes with air to a depth of as much as 600 to 800 feet, one large geophysical operator adds considerable water to the air stream to go through sticky shale. They have found that an admixture of dust resulting from grinding action of the bit in dry formations adds sufficient density to the air stream to successfully bring up cuttings at a velocity of 60 feet per second. This probably approaches the equivalent of the mist of oil used in the gas drilling job first described.

Successful operations on a full scale in the field using gas or air have been reviewed for the following types of drilling:

1. Drilling below the shoes of water strings and in a reduced-pressure oil sand; recycling gas with compressors in a closed system.
2. Drilling in gas sands; utilizing available high-pressure gas and blowing it to the air with the cuttings.
3. Drilling in a fracture system oil sand; utilizing compressed air and blowing it to the atmosphere with the cuttings.
4. Drilling for surface casing to avoid known severe lost circulation condition; utilizing compressed air and blowing it to the atmosphere with the cuttings.

Other applications no doubt will be tried. It is suggested that the method would be considerably enhanced if it could be made available to the industry on a service basis with trained personnel and with portable compressors suited to the work. In this manner, all concern as to safety would be reduced to a minimum where it rightly belongs.

Our Thanksgiving Proclamation . . .

Each in his own way has something for which to be thankful. But, at this season of the year as we pause to "take stock" of all the fine things which have come our way, we are most grateful for the many old friends and new acquaintances we are privileged to serve throughout the oil industry. Wherever you are, please accept this as our deep felt, personal expression of gratitude—for riches which can never be measured in dollars and cents.

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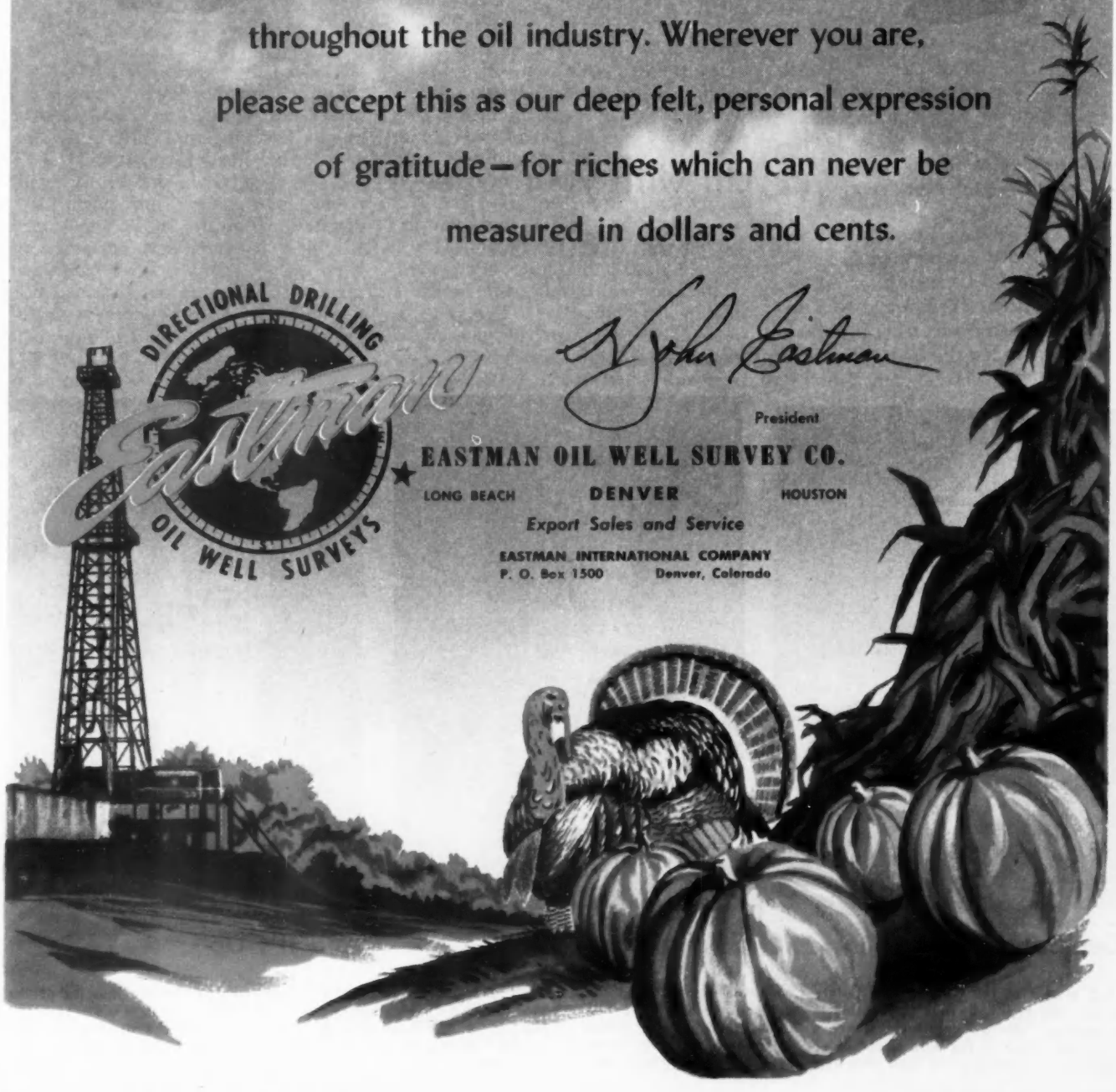
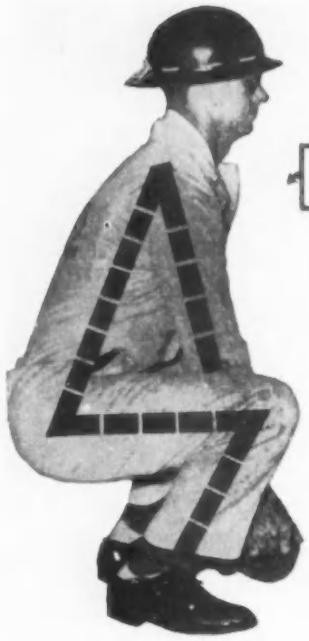




LEARN TO LIFT

Lift with your legs–
Save your back

Get Set . . .

Straighten the Legs . . .

And It's Up

Fred Winter of the Hughes Tool Safety Committee demonstrates the proper way to lift. Be sure the footing is good and the hands are free of grease. Take a comfortable stance with the feet about 12 inches apart and close to the base of the object to be lifted. Bend the knees outward and straddle the load somewhat. Take a firm grip, then rise, keeping the back straight and employing the strong muscles of the legs and arms. Note that in the "up" position, which is also the carrying stance, the load is close to the body and the arms are at full length, which allows for proper distribution of weight on the arms and shoulders.

In handling bulk material it is even more important that the footing be good and the hands free of grease.

HANDLING of objects causes 22 percent of all industrial injuries. R. G. Naul, manager of the Safety and First Aid Department, Hughes Tool Company, Houston, declares these injuries are caused by:

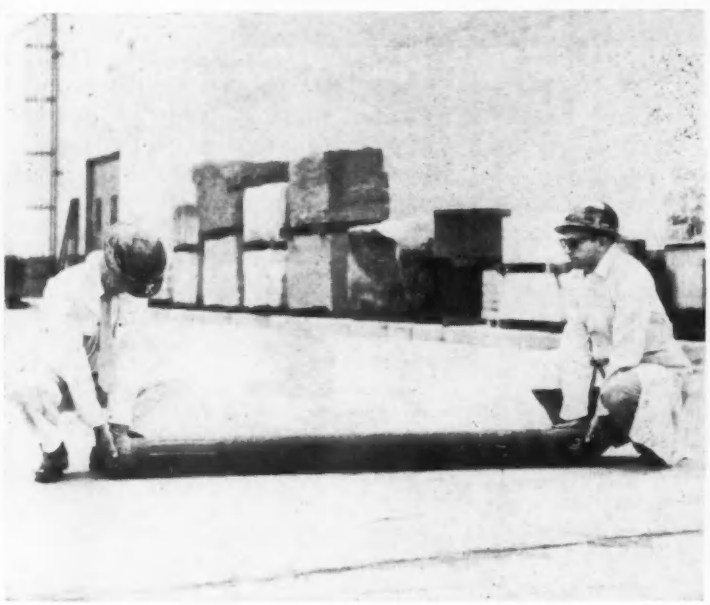
- Lifting the wrong way, which results in undue strain on certain muscles and ligaments—notably the back and groin.
- Lack of coordination in team lifting, resulting in too heavy a burden upon one or more.
- Lack of lifting and conveying equipment.
- Overtaxing of physically fit workers through failure to use available mechanical equipment or through management's failure to set a reasonable limit on the weight of objects to be lifted or carried.
- Poor housekeeping, resulting in tripping and slipping hazards.
- Lifting by employes not physically capable of handling the job.

All of these hazards except those involving the technique of manual lifting can be minimized through management planning and the proper response from supervisors. But men must be trained in the art of lifting, both individually and as a team.

This training may be done in two phases:

1. Instruct all foremen, supervisors and workers in the proper methods of lifting.

2. Instruct new employes as a part of the indoctrination program. This can be accomplished in training sessions, by lectures, demonstration of a wooden model showing muscular stress in various lifting positions and by visual education.



Team lifting is more hazardous than the individual lift because of the coordination required. It is essential that one man be in charge of the team lift and that he have a set of signals. This assures complete cooperation which equalizes the burden and avoids injury when an object is being lifted or laid down. R. C. Naul, left, and C. L. (Cliff) Dietrich demonstrate the approach and the carrying stance of the team lift. In carrying an object such as this, the team should walk in step, like soldiers marching in single file. This avoids jarring and reduces the possibility of dropping the load. Naul recommends that an object of the size pictured here be handled by mechanical devices, where possible.

Wells in Lake Texoma. Derrick in distance is in approximately 35 feet of water.

Operators Solving Offshore Problems In Oklahoma Field

The wells in Lake Texoma are costly and hard to drill. But the chances of deeper production are good.

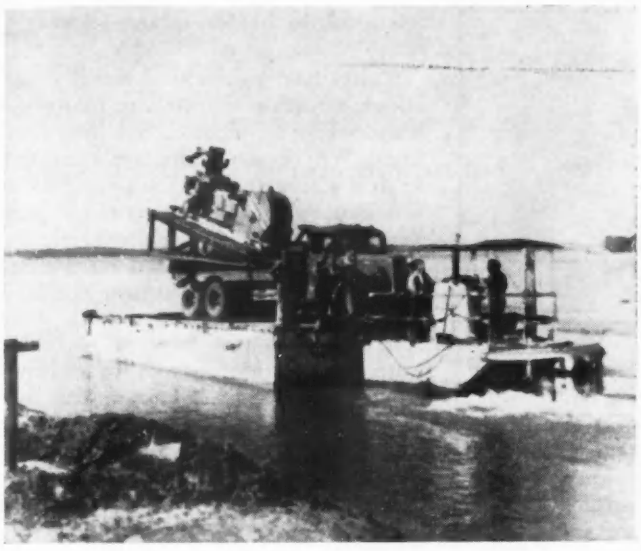
Drilling on dirt causeway in Lake Texoma.

By HUBERT E. BALE

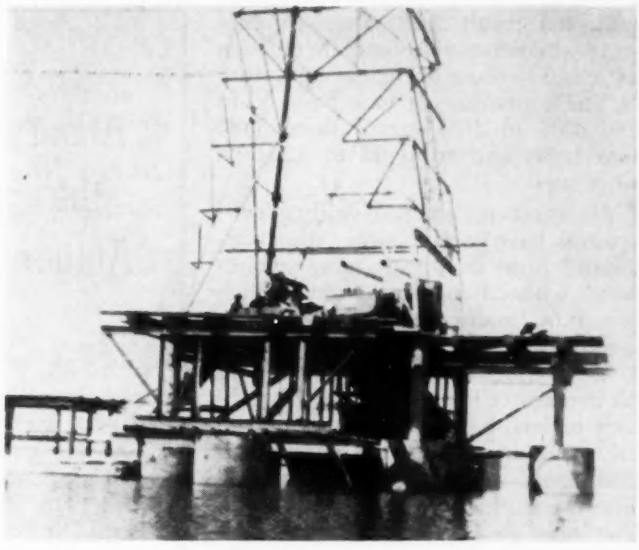
THE OIL MAN familiar with Oklahoma's geographical location gets quite a kick when he visits the Aylesworth field in the southern part of the state. Part of the field closely parallels the northern shore of Lake Texoma, an impressive body of water, but many wells are located in the lake itself. As the observer gazes across the broad expanse of water and sees the many derricks silhouetted against the horizon (and if he's visited Venezuela) he thinks of Maracaibo. True, there are not as many wells in Lake Texoma as in Maracaibo, but the showing is impressive and he can be sure that the men who operate there are coping with similar problems.

Aylesworth is perhaps the Mid-Continent's largest inland "off shore" oil operation. Some wells there have been drilled in as much as 35 feet of water—deeper in many instances than

Unloading truck from barge to derrick floor.



Loaded barge moves to location.



Derrick on substructure.

wells drilled in the tidelands areas of Louisiana, Texas and California. Although Lake Texoma is not subject to violent storms which characterize the open waters of the Gulf of Mexico and multi-million dollar platforms are not necessary, the landlubber oil men who work there have mastered the arts of marine-type operations and are successfully developing an important oil reserve.

Structure. The Aylesworth pool is in T6S-R6,7E Marshall County. It produces from the Bromide zone of the Simpson formation found at approximately 3200 feet. About 65 producing wells have been drilled to date and development is still in progress. The structure is a narrow, steeply folded elongate anticline trending southeast-northwest across at least seven miles. Production has been found on the south flank only so that the pool is about seven miles long and only about one-fourth to one-half mile wide. The structure is thought to be faulted down on the north-northeast side. Many geologists believe also there are several minor cross faults.

Formations Eroded

In particular, at the west-northwest end of the structure as presently known, the older formations were upturned and eroded before deposition of the Caney shale with the result that the Caney rests upon the eroded edges of rocks from Mayes-Sycamore down to at least the green shales in the Simpson formation below the dense limestone. In cross-section this takes place within a distance of about one-half mile on the south-southwest flank of the structure and results in formation dips of 25° to 30° or more.

Producing Zones. Sands sometimes found in the lower part of the shallow beds of Cretaceous age produce some gas in the Aylesworth pool. The nearby shallow Madill pool (5S-5E and 6E) is a long narrow shoestring type pool where high gravity oil production comes from the so-called "Arbuckle" sand at about 550 feet. This sand is thought to be of Pennsylvanian age and to have been upturned and truncated before deposition of the Cretaceous beds.

The shallow Cretaceous gas at Aylesworth has at times caused considerable trouble in drilling—it has been responsible for a few blowouts and may have been responsible for some fires which did considerable damage.

A few wells have found relatively thin sand in the Caney (Springer) shale with shows of gas, but so far, no commercial wells have been developed. Likewise, shows of gas have been reported in the Mayes-Sycamore limestone zone, but no wells have been completed in this zone.

Shows of oil and/or gas have been reported in the Viola limestone, but no wells have been produced commercially from the Viola.

The main producing horizon at Aylesworth is the Bromide zone. There are three well developed Bromide sands in the eastern part of the pool, but in the western part the top sand is generally not present.

The total thickness of the Bromide producing zone is about 200 feet of which about 40 to 50 percent is sand, usually as two to three sand members separated by green shales and gray shaly and dolomitic limestones. Generally the sands are rather hard and often somewhat calcareous.

No production has been found at Aylesworth below the Bromide sand zone. Several wells have been drilled through the McLish sand which is about 90 feet thick and some 500 feet below the Bromide zone. Shows of oil have been reported, but no commercial production developed.

The Oil Creek sand, about 175 feet thick and some 900 feet below the McLish, has been drilled in at least one well.

Production Expected

While no production has yet been developed in these older beds at Aylesworth, both the McLish and Oil Creek sands can be expected to produce since both zones produce in the Cumberland pool some five miles to the northeast. Likewise, the McLish is presently being developed in the Mannsville pool some 12 to 15 miles to the northwest and the Oil Creek sand is a prolific producer in the presently developing Sandusky area about 25 miles southwest in Grayson County, Texas.

Drilling and Development. Almost all drilling in the Aylesworth pool has been done with rotary tools. In the early days water base mud was used altogether and since most contractors, in those days particularly, thought light mud aided in the speed of drilling, muds which we now would consider unusable were used

with the result that many troubles were encountered. Some holes even were lost because of the caving nature of the formations. It took from 60 to 180 days to drill one of these 3500 foot holes and from 65 to 120 bits were used.

Since companies and drilling contractors have become more "mud conscious" little trouble is now encountered with caving formations. Muds are now maintained with average weight of about 10 to 11 pounds per gallon, funnel viscosity of about 40 to 65 and water loss of 3 cc per 30 minutes or less. Some contractors use an oil emulsion mud made by mixing crude soap and crude oil or distillate into the mud. It is thought this emulsion aids in keeping the water loss down as well as acts as a sort of lubricant to the bit and drill pipe when they come in contact with rock formations.

Where the full geological section is drilled, including Mayes-Sycamore, Woodford, Viola and Simpson, it still takes about 60 to 75 rock bits and about 60 days to drill one of these wells.

The wells are drilled with tolerance of 6° from vertical and in doing so it is necessary to "hold up" the weight on the bit to 1 to 3 points (1000 to 3000 pounds) which has a tendency to wear out the bearings in the bit before the teeth are dull.

Added Expense

Drilling in Lake Texoma itself entails considerable added expense and more time is used both in drilling and producing the wells. In the eastern end of the pool where the water is deep enough to float an adequate "barge," the wells have been drilled from a platform erected on a substructure with legs set on the bottom of the lake, and the drilling and producing equipment is transported to and from the platform by barge.

The "legs" of the substructure usually consist of steel cylinders 4 to 8 feet in diameter being set on the bottom of the lake and filled with rock and concrete then braced and tied together with beams and pipe welded to these legs. When the substructure is erected and platform constructed on it, then the derrick is erected on the platform and the tools and equipment moved into place to commence drilling.

In the western end of the pool where the water in the lake is too shallow to float a barge, the practice has been to build a dirt causeway from the shore to and around the location. Some of these causeways have been as much as 1200 feet in length and up to 15 feet high.

Completing and Operating. The surface water level in Lake Texoma is generally below elevation 620 so the practice in building a dirt causeway is to raise it to about elevation 625. During flood time (usually May and June) the last three years the water in the lake has been above elevation 625 for a time, but usually for only a few days. The highest the lake has ever been was at elevation 629 and that was several years ago. The spillway for Lake Texoma is at elevation 640 so it would be possible for the water to get that high in the lake, which would be about 15 feet above the average causeway level. According to the U. S. Army Engineers, based upon past records, this maximum depth should occur on the average of once in about 40 years.

In setting pumping units and semi-permanent installations on the wells, most operators place engines and equipment, which would be seriously damaged by water, above elevation 630.

Tank batteries are generally set above elevation 640 and in many instances this requires rather long flow lines. Where the wells are operated from a causeway, the lines can follow the causeway and present no particular problems other than length. Where wells are operated on a platform built on a substructure, the flow lines must be placed on the lake bottom and they may present problems both in installing and operating. Aylesworth oil contains considerable paraffin so that both tubing and flow lines need almost constant attention. Some operators use solvent and some prefer "steaming." Sucker rods with scrapers on them are used satisfactorily by some operators.

Casing and Tubing. Surface casing, usually 10¾ inches, is generally set through the shallow Cretaceous beds at about 650 to 750 feet and cemented from top to bottom. Wells drilled in the lake, whether from a platform or causeway, require a conductor string usually 15½ inches and 60 to 100 feet long likewise cemented bottom to top. The most satisfactory flow string is 7-inch casing. In the older wells the flow string was generally set at the top of the Bromide sands and the sands shot with rather heavy charges of nitroglycerine. This required considerable cleaning out after the shots.

Methods Used

More recently, since the development of jet perforating and formation fracturing the most satisfactory method of completion seems to be to set casing on top of the lower sand, jet perforate all sands, both in open hole and through casing, then formation fracturing each sand separately by use of tubing packers. Some operators follow the practice of washing the sands with acid before the formation fracturing job.

On the whole, Oklahoma's only "off shore" field presents drilling and operating problems which have taxed the ingenuity of operators. The wells are expensive and hard to drill. The average completed well in Aylesworth, with average depth of about 3500 feet, costs about $75,000. Fortunately, structural conditions are sufficiently well defined so that a minimum of dry holes can be expected. Prospects for developing deeper production are good and, for operators who are not scared of the water, the field offers excellent production possibilities.

About the Author

HUBERT E. BALE was graduated from Oklahoma University in 1924 with a BS degree in geology. He was assistant geologist with Marland Oil Company from 1924-1926; district geologist for Texas Pacific Coal and Oil Company, Oklahoma City, 1926-1928; Chief Geologist for William H. Atkinson, Oklahoma City, 1928-1932; and consulting geologist in Oklahoma City 1932-1952. In January, 1952, he moved to Dallas. In 1945 Kirkpatrick & Bale, Inc. was organized — obtained production in Carter, Seminole, Hughes and Pontotoc counties, Oklahoma. In January, 1950, Bale withdrew from Kirkpatrick & Bale and became operator and drilling contractor on his own.

The importance of efficiency cannot be overemphasied. Here's a discussion of principles and some of the problems of

Cost Accounting for Drilling Contractors

By F. H. ROUSEY, C.P.A.
Arthur Young & Company, Tulsa

SINCE THE END of World War II, the drilling industry has undergone a major change in both its operational and administrative functions. This change is due in large measure to the increased number of available rigs which has had the effect of greatly reducing the number of cost-plus contracts and stimulating competitive bidding. During this same period, statistics show that while the rate of penetration and the overall rig efficiency have increased, such advances have been able to offset only partially the rapid rises in the cost of labor, material and equipment. These factors have served to point up the need for more adequate cost accounting to provide the data required for competitive bidding on a basis that will yield a fair profit to the contractor.

Preliminary Considerations

In setting up a cost system, or revising the present accounting system to provide more accurate cost data for the drilling contractor, it is necessary to determine the following:

1. Financial statements required by management.
2. Cost statements required for review by operating personnel and for use in computing future bids.
3. Information required for billing reimbursable expenditures.
4. Details required for federal, state, and local tax and information returns.

The cost system should be designed so that the required information may be readily assembled from the accounting records. For the sake of simplicity the account classification should be limited to those accounts required for report and analytical purposes.

The job order cost system, which assigns a job number to each contract or project and provides for the recording and accumulation of costs for each job, is recommended for the drilling contractor. Upon completion of a well, such system provides cost data by contracts without burdensome and time-consuming analysis.

Cooperation With Field Men

A large portion of the basic information with respect to items of cost must originate in the field with the personnel directly responsible for the drilling rig and the service departments. The lack of such information requires the accounting department in many instances to record costs by guesswork, a practice that nullifies the advantages of cost accounting. For a good many years field personnel seem to have adhered generally to the belief that it is unnecessary to furnish information for accounting purposes. This unrealistic attitude is gradually being changed by the management of many drilling contractors through educational programs which show the value of accurate cost information and the necessity for full cooperation between the field personnel and the accounting department.

Material Transfers

A workable material transfer system is a necessity in accounting for costs by contract. Material and supplies purchased and charged to one location and actually used on other locations will distort the costs by contract unless a transfer of such costs is made by the accounting department.

The only sound basis for such an adjustment is a material transfer. Due to the large number of transfers between locations, absolute control of such transfers is essential. Transfers should be prenumbered and in sufficient detail to insure accurate handling by the accounting department.

Reimbursable Expenditures

Reimbursable expenditures are an important factor in the accounts of a drilling contractor and present numerous problems. It is preferable to charge such items to a balance sheet account to be transferred to accounts receivable when billed. By handling such items in this way, costs will not be overstated and accurate cost and financial statements can be prepared at any time. Due to the lack of uniform drilling contracts, the segregation of reimbursable expenditures from costs covered by the contract price becomes more difficult as the number of rigs in operation increases, and special care must be exercised to insure the elimination of reimbursable expenditures from actual costs chargeable directly against the income from the contract.

Troublesome Items of Cost

The ideal cost accounting system would provide for the charging of all costs to specific contracts on a usage basis. In some cases it is impracticable to charge certain costs on this basis and in other cases impossible. Overhead which represents costs that cannot be charged as used should be

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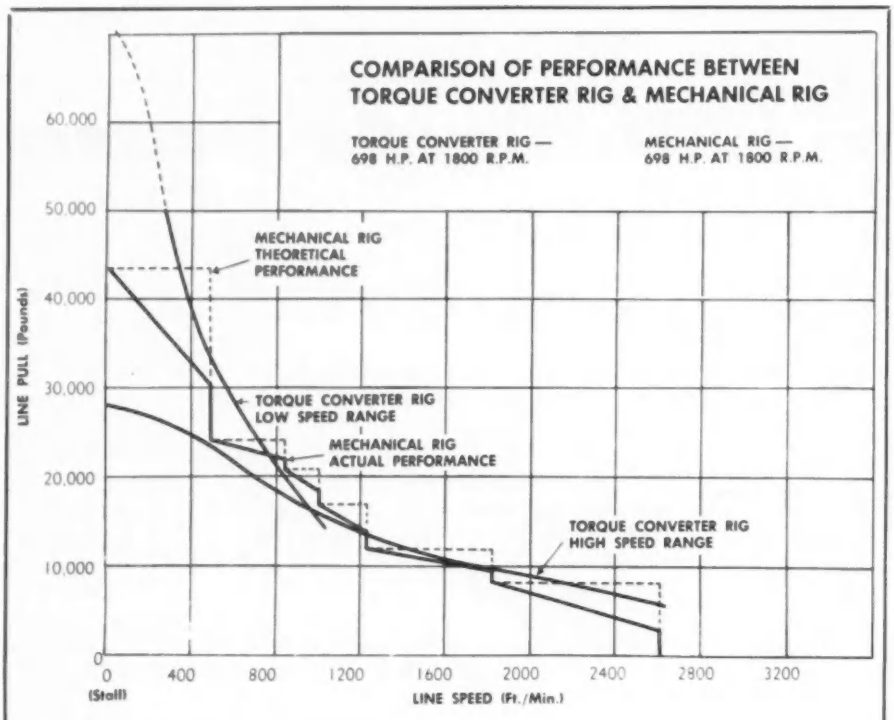
Torque Converters Supply Flexibility and Economy



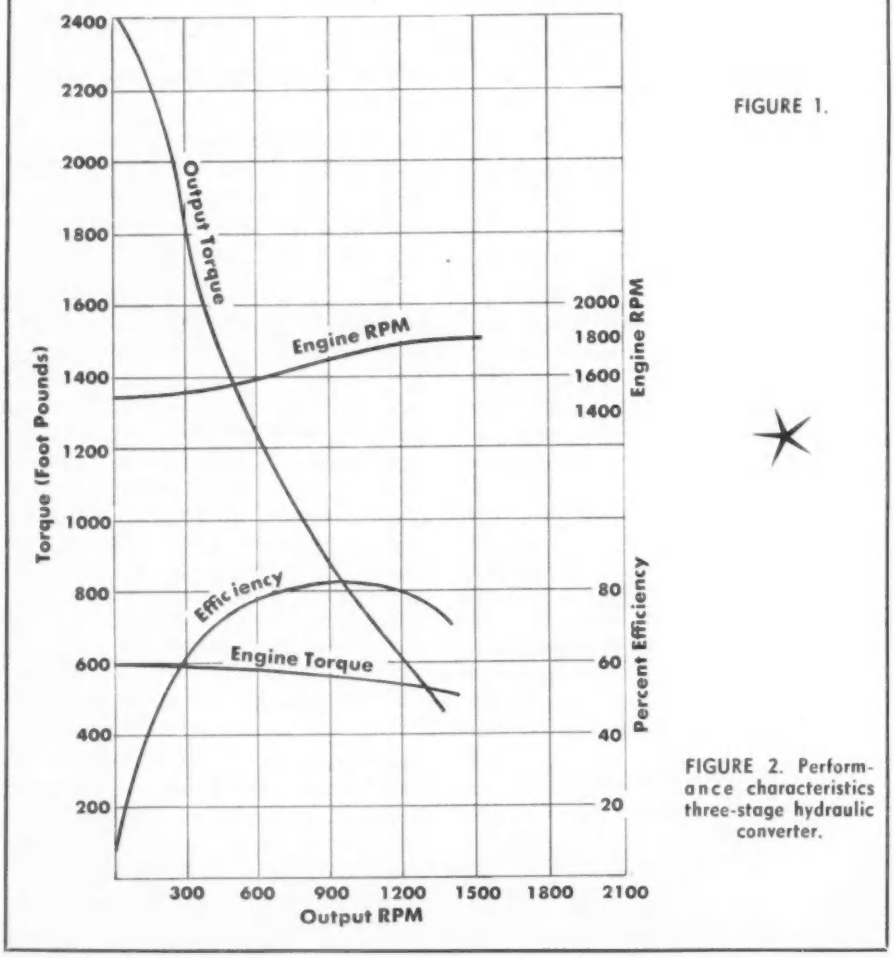


FIGURE 1.

FIGURE 2. Performance characteristics three-stage hydraulic converter.

Here's a tool that represents one of the largest single improvements in a new era of power rig design.

By M. L. COOPER

**TECHNICAL SERVICE DEPARTMENT
DRESSER EQUIPMENT COMPANY
IDECO DIVISION, MIDLAND, TEXAS**

THE FLEXIBILITY of steam with the economy of internal combustion power . . . such is the contribution made by the application of hydraulic torque converters to the modern drilling rig. This flexibility provides infinitely variable speeds with high torque multiplication which reaches peak torque at stall condition. Also, it permits the drilling rig automatically to adjust speed ratios to the most favorable operating condition.

This smooth transmission of power through fluid protects the engine and hoist from shock, and provides cushioned acceleration for hoisting and rotating. In addition to the economies found in the more simplified design of the torque converter hoist, additional advantages have been found in its greater over-all efficiency in the transfer of power to the hook with the resultant savings provided by faster round trips. Also, engines are permitted to produce nearly full power regardless of load conditions, and, too, the simplified controls reduce operator fatigue and increase crew efficiency and safety.

Today's automobiles, which use torque converters, have fairly well introduced this means of power transmission to the general public. However, the drilling rig, because of the nature of drilling operations, derives a much greater benefit from the characteristics of the torque converter. Unlike the automobile, which contin-

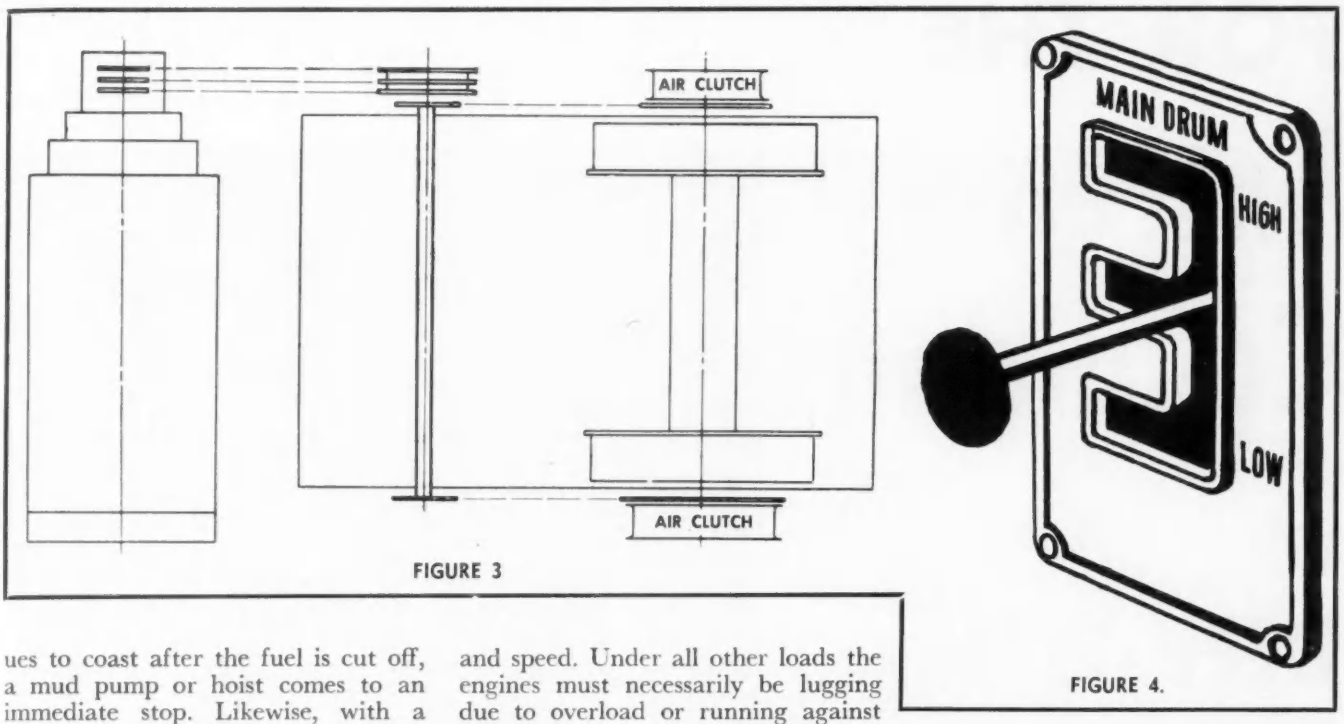


FIGURE 3

FIGURE 4.

ues to coast after the fuel is cut off, a mud pump or hoist comes to an immediate stop. Likewise, with a drilling rig there is a continuous starting of heavy loads which vary throughout the drilling operation.

A torque converter is, in principle, a centrifugal pump and an hydraulic turbine, both contained within a single housing. This unit automatically selects the speed ratios needed to provide the most favorable operating conditions. In effect, it is an infinitely variable transmission. Compare this to the transmission of a typical mechanical drawworks. These mechanical rigs usually have six speeds which are obtained through an arrangement of chains and clutches in the transmission. Naturally, all six of these speeds must be considered as having fixed ratios. It follows, therefore, that the rig is in the correct gear only for six combinations of load and speed. Under all other loads the engines must necessarily be lugging due to overload or running against the governor and wasting power because of an insufficient load. Figure 1 shows the ideal and actual speeds of hoisting of a conventional six-speed rig as plotted against a similar two-speed rig equipped with torque converters.

Figure 2 is a performance chart of a typical three-stage hydraulic torque converter. It illustrates how the output torque and speed of the converter follows a smooth curve from maximum torque at zero speed to approximately the full engine torque at three-fourths engine speed. Note that with the engine governed at 1800 revolutions per minute, there is only a small drop in engine speed when the output shaft of the converter is stalled. This shows how the engine driving through the torque converter develops close to full horsepower regardless of the load on the converter output shaft.

Torque converter rigs are designed and ratioed to keep the torque converter operating above 70 percent efficiency. Only two ratios are required to prevent the torque converter from overheating due to loss of efficiency. The high and low speeds shown on Figure 1 correspond to these two-speed ratios.

Figure 3 illustrates a power layout diagram of a simple torque converter rig. From the output shaft of the converter which is mounted on the engine, a chain drive extends to the counter shaft which in turn provides two chain drives, one each to the two

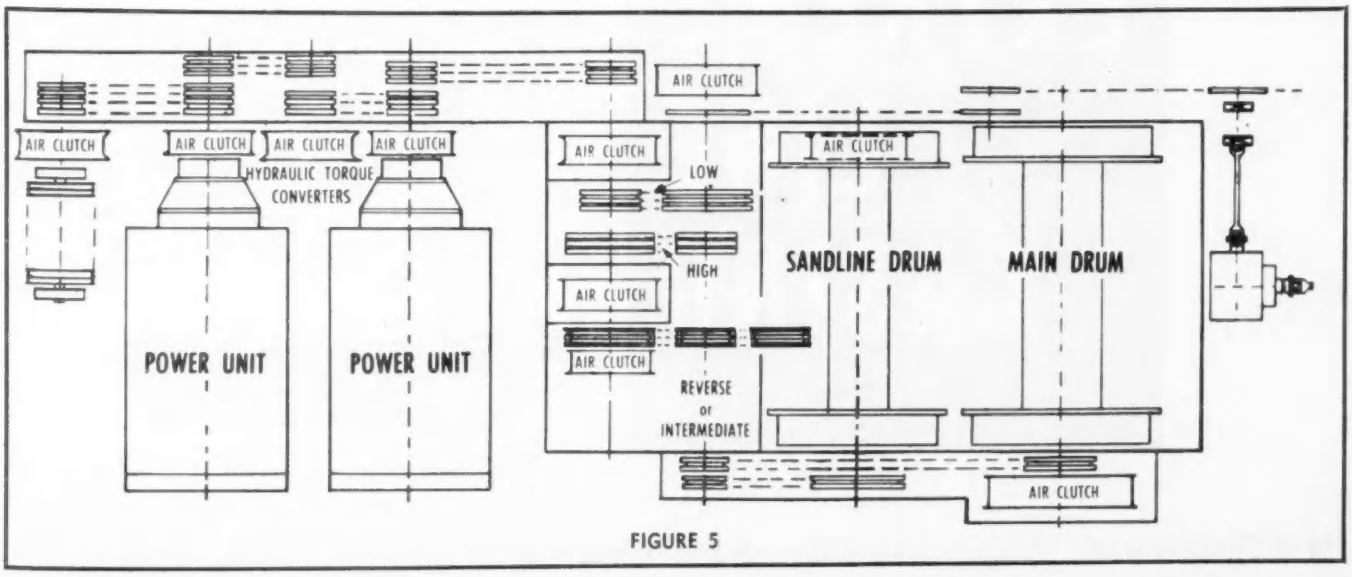
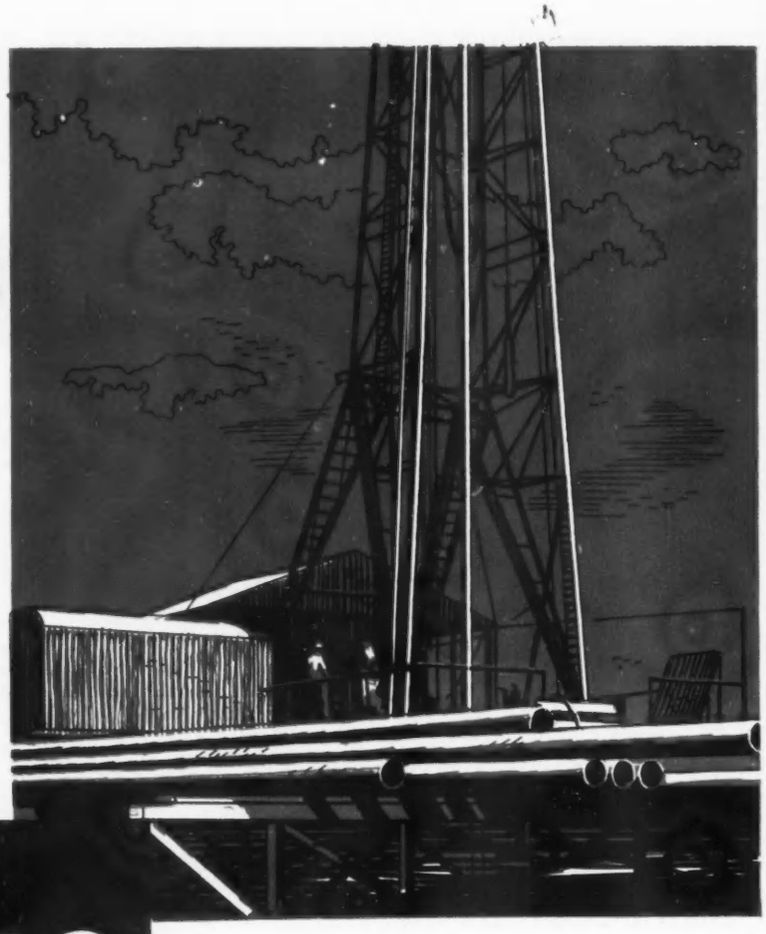


FIGURE 5

FOR THE Extreme Conditions of DEEP-WELL COMPLETION—



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- **Positive fluid seals**
- **Maximum running-in efficiency**
- **Minimum outside joint diameter**
- **Resistance to thread damage**
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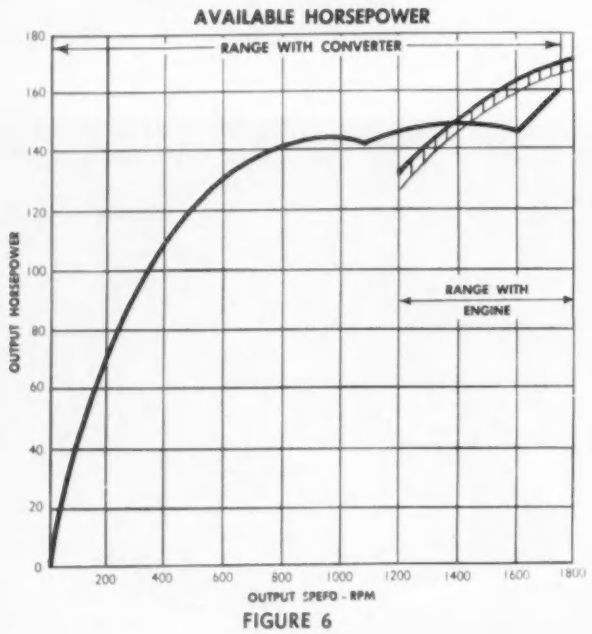

FIGURE 6

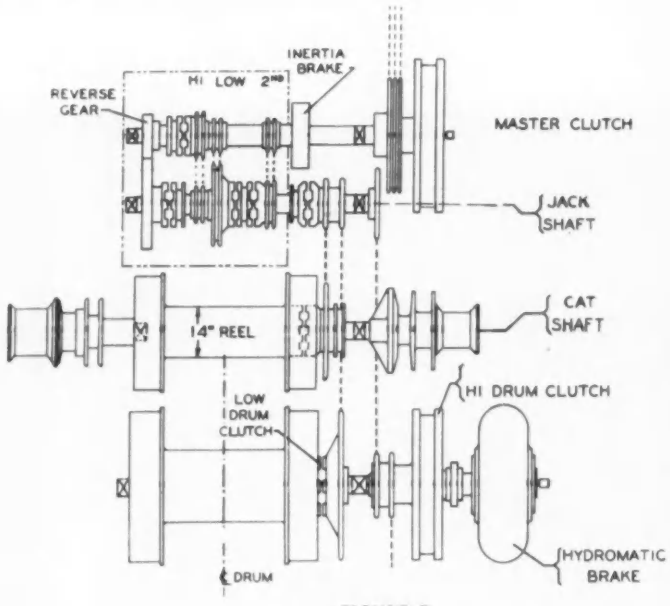

FIGURE 7

air operated main drum clutches. With such a unit one speed is provided to the rotary table, which has proved satisfactory when a mud pump is not driven from the hoist engines. Figure 4 illustrates the simple control mechanism on this rig.

When the main drum lever is pushed vertically to the top or bottom position, air enters and engages the high or low drum clutch whichever has been selected. Moving this lever to the left in any one of the three horizontal slots opens the engine throttle. It can be readily seen that the clutches cannot be engaged until the engine throttles are in the idling position. Since the clutches are always engaged or disengaged with the engines idling, they are not subjected to slipping or abuse. In contrast to this, when a mechanical rig is started the clutches slip and the engine speed is pulled down. The torque converter is designed to slip and does so without damage to itself or to the other machinery.

Some field operating conditions require a rig equipped with a reverse. Figure 5 shows a larger torque converter rig which incorporates a transmission to provide two forward speeds and one reverse speed. On this rig only a single drive is required to the main drum. By utilizing air operated clutches in the transmission, the driller still has the high-low shift and can shift from one to the other with little delay.

A torque converter imparts a small amount of motion to the output shaft even when the engines are idling. This characteristic has led to the general adaptation of air clutches to the torque converter rig, as it would be necessary to disengage the power input by means of a master clutch and to stop the shafts with an inertia brake to make a shift with jaw or splinted type clutches. Also, this would require additional elements in the rig and increase the time and effort on the part of the driller. Another advantage of air clutches is that the two forward speeds and reverse can be controlled with a single lever. For certain operations, such as slowing down the cathead shaft for breaking joints or lifting heavy strings of pipe out of slips, the driller makes the shift because it is easy to do so with a flick of the wrist.

Figure 6 illustrates how engine power ranges are extended by the use of torque converters. It is evident that with a mechanical rig, as the load in-

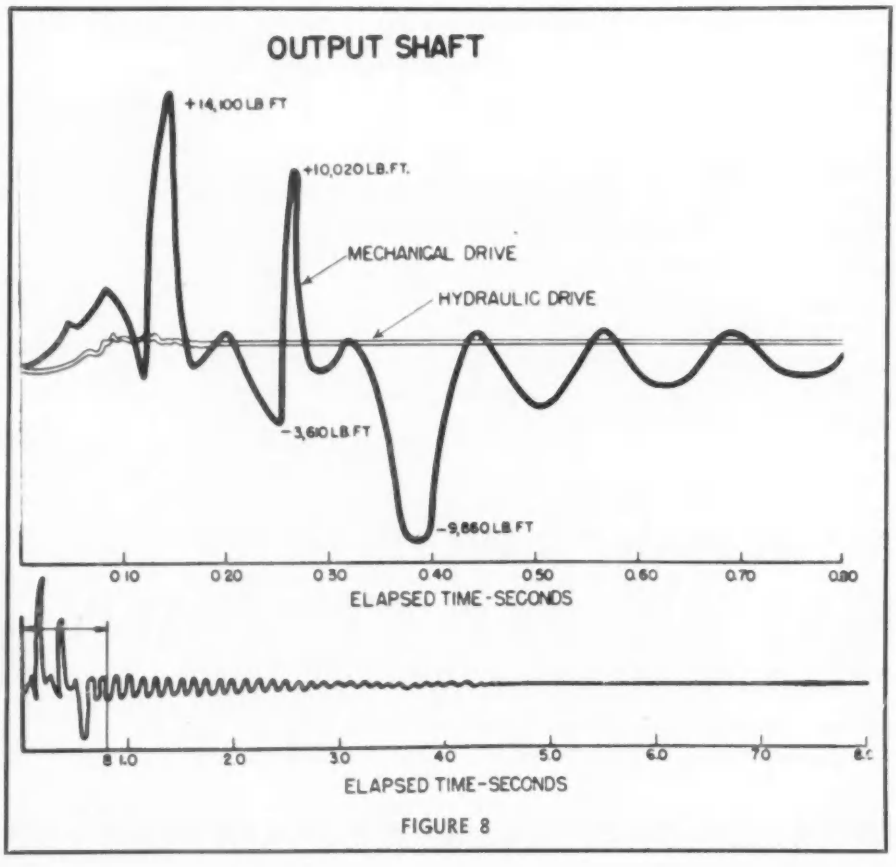

FIGURE 8

Five important reasons why
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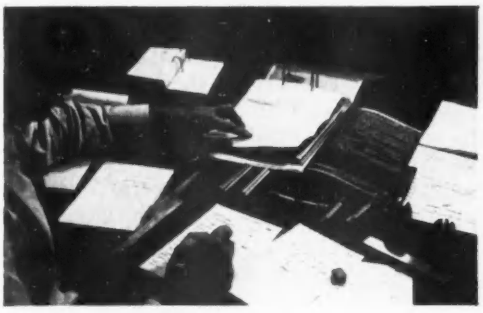
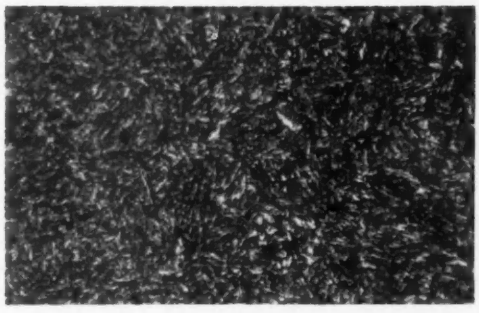
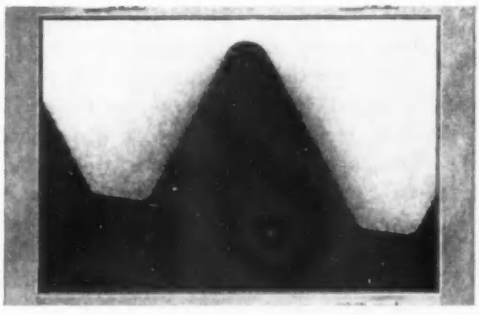


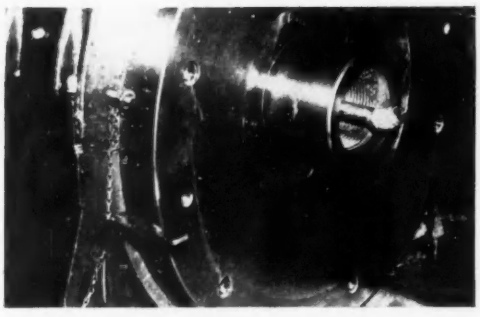
BETTER STEEL. REED specifications for a tool joint steel call for *better* properties than those obtained from AISI specifications based on chemical and hardenability requirements only.



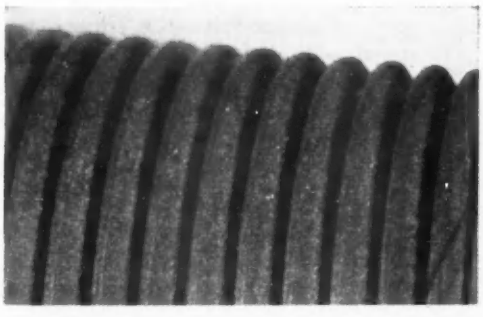
"TAILORED" HEAT TREATMENT. REED "tailors" heat treating to each heat of steel instead of using a treatment based on average analysis. This makes **REED** Tool Joints even stronger and more wear resistant.



ACCURATE THREADS. REED uses many modern inspection tools—including the thread comparator shown here—to make sure the threads on the tool joints you get are absolutely accurate.

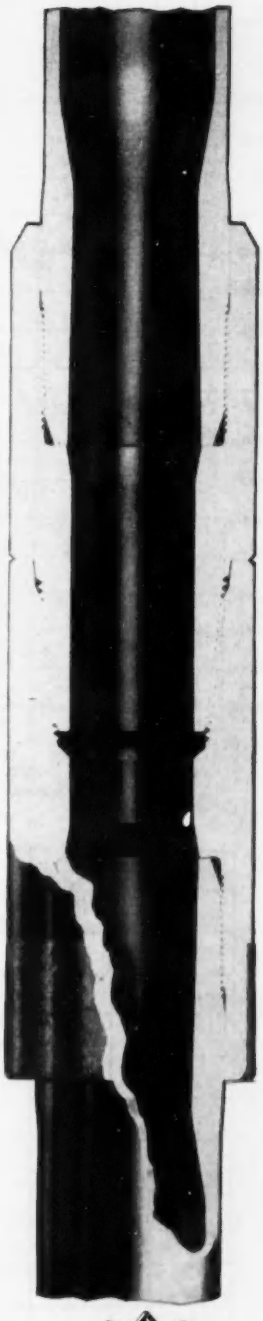


PERFECT ALIGNMENT. REED uses special adapters in machining that assure perfect alignment of every **REED** Tool Joint. Perfect alignment prevents the high stresses and uneven wear and whip that could cause drill string failure.



TREATED THREADS. Wearing threads of all **REED** Tool Joints are given a treatment that changes the surface of the steel into a complex metal phosphate. This surface acts like a lubricant and prevents galling.

The more you know about **REED** Tool Joints, the better you can understand why they last longer. This longer life means greater safety and lower drill string costs. It is the main reason why leading operators all over the world specify **REED** Tool Joints.



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creases, engine speed and power decreases. To maintain the power output, it would be necessary for the operator to continue to shift throughout the six speeds, which are a minimum for mechanical rig operation. As torque converter rigs need only two ratios, the result is a much simpler design which requires fewer parts, which are subjected to considerably less wear and breakage than are mechanical transmissions.

An examination of Figures 5 and 7 illustrates the simplicity of the torque converter rig over the conventional mechanical rig. In Figure 7 it can be seen that a mechanical rig contains five chain drives and six clutches (counting the master clutch). All of these elements still enable the rig to obtain only six forward speed ratios. The torque converter rig in Figure 5 has only three chain drives and clutches to obtain an infinite number of forward speed ratios.

The importance of the torque converters' ability to absorb shock is shown graphically in Figures 8 and 9. Figure 8 was plotted as a result of laboratory tests.[1] It shows the shock loading of an output shaft in the transmission during a shift under full power, both with and without a torque converter. The test without the converter shows that there were loadings ten times greater than normal after engagement. This period lasted for one second. Then, during a period of five or six seconds the shaft shows that it was subjected to torsional vibration. It will be noted in the other plot that the torque converter absorbed or dampened practically all of this shock and torsional vibration. Figure 9 was plotted as a result of field tests.[2] The maximum load shown on the chart was taken from the highest point on the weight indicator as indicated by the needle as the load was picked up. The normal hoisting load was that point at which the needle steadied as the load was accelerated. The torque converter equipped hoist illustrated on this chart indicates that it has absorbed about 70 percent of the starting shock and vibration.

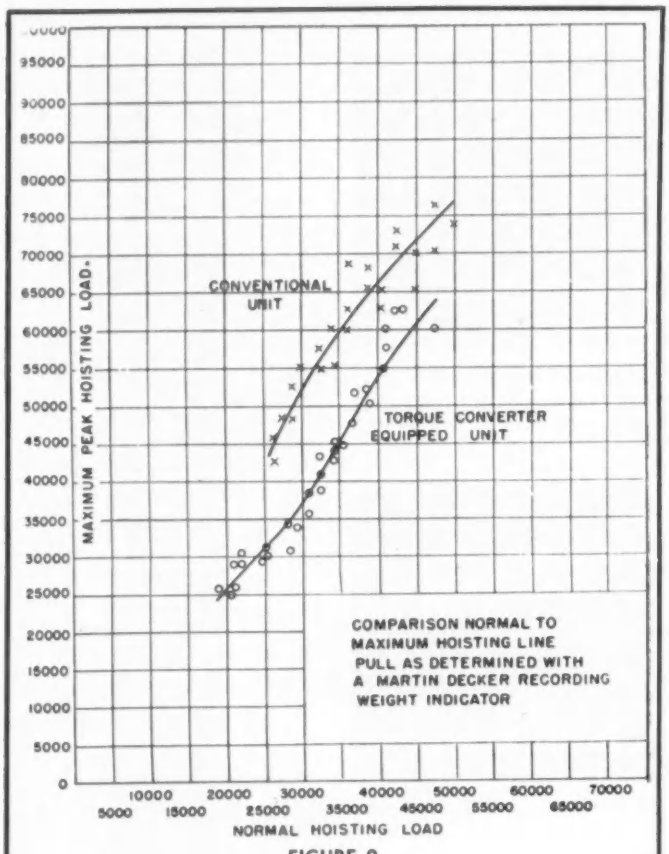

MAXIMUM PEAK HOISTING LOAD
NORMAL HOISTING LOAD
CONVENTIONAL UNIT
TORQUE CONVERTER EQUIPPED UNIT
COMPARISON NORMAL TO MAXIMUM HOISTING LINE PULL AS DETERMINED WITH A MARTIN DECKER RECORDING WEIGHT INDICATOR

FIGURE 9

HOISTING TIME IN SECONDS
CONVENTIONAL DRIVE HOISTING IN THIRD
CONVENTIONAL DRIVE HOISTING IN HIGH
TORQUE CONVERTER EQUIPPED HOISTING IN HIGH
COMPARISON HOISTING TIMES BOTH HOISTS POWERED BY SAME MAKE AND HORSEPOWER ENGINE
60 FT. STANDS 4½ — 16.6 POUNDS DRILL PIPE

FIGURE 10

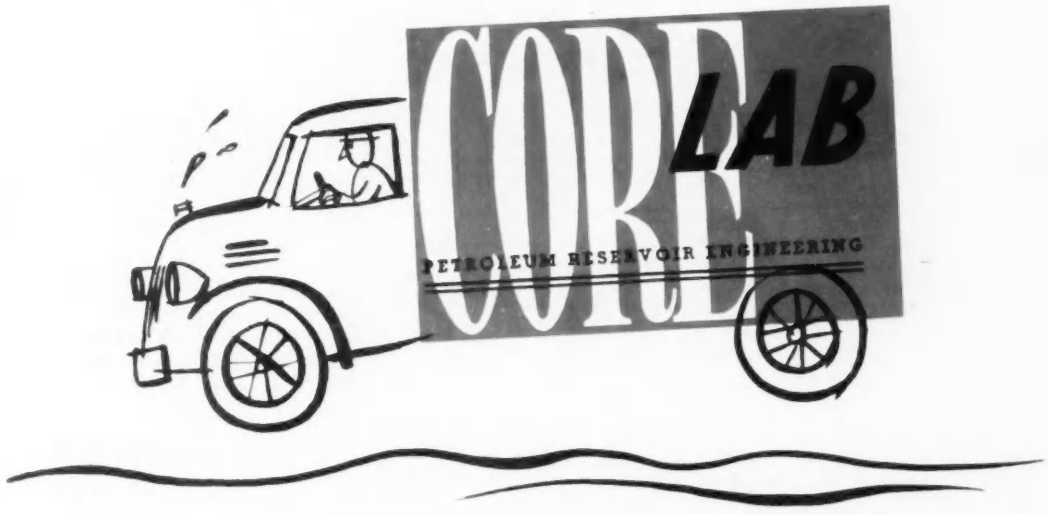
Cutting Action Smoothed

Rotary table operation is also improved by the action of the torque converter which smooths out the cutting action of the bit, thereby reducing the chance of drill pipe failure. When the drilling bit hangs up the rotary merely slows down and then speeds up again as the bit is released. Any desired rotary speed may be obtained by throttling back the engine without appreciable loss of efficiency in the torque converter. Torque converter rigs operated by fishing tool men on milling operations are credited with making the mill "cut like a lathe."

The number of speeds required by the rotary table on a torque converter rig depends upon how the power is divided. When the No. 1 engine is used alone to drive the rotary, two speeds will cover the full range. If all engines are compounded to drive both the rotary and pump, more flexibility may be desired so that the pump can be run fast and the rotary slow, or vice versa. Four speeds can be obtained for the rotary either by placing an additional two-speed package between the rotary countershaft and the table or by incorporating a two-speed drive in the front end of the engine compound.

Faster hoisting is possible with a converter rig. This is true as the engines are running close to governed speed at all times and because every stand that is pulled automatically comes a little faster than the one before. This is illustrated by Figure 10 which shows the result of field tests on two identical rigs, one with a converter and one without.[2] Figure 11

"You make hole... we'll make tracks!"



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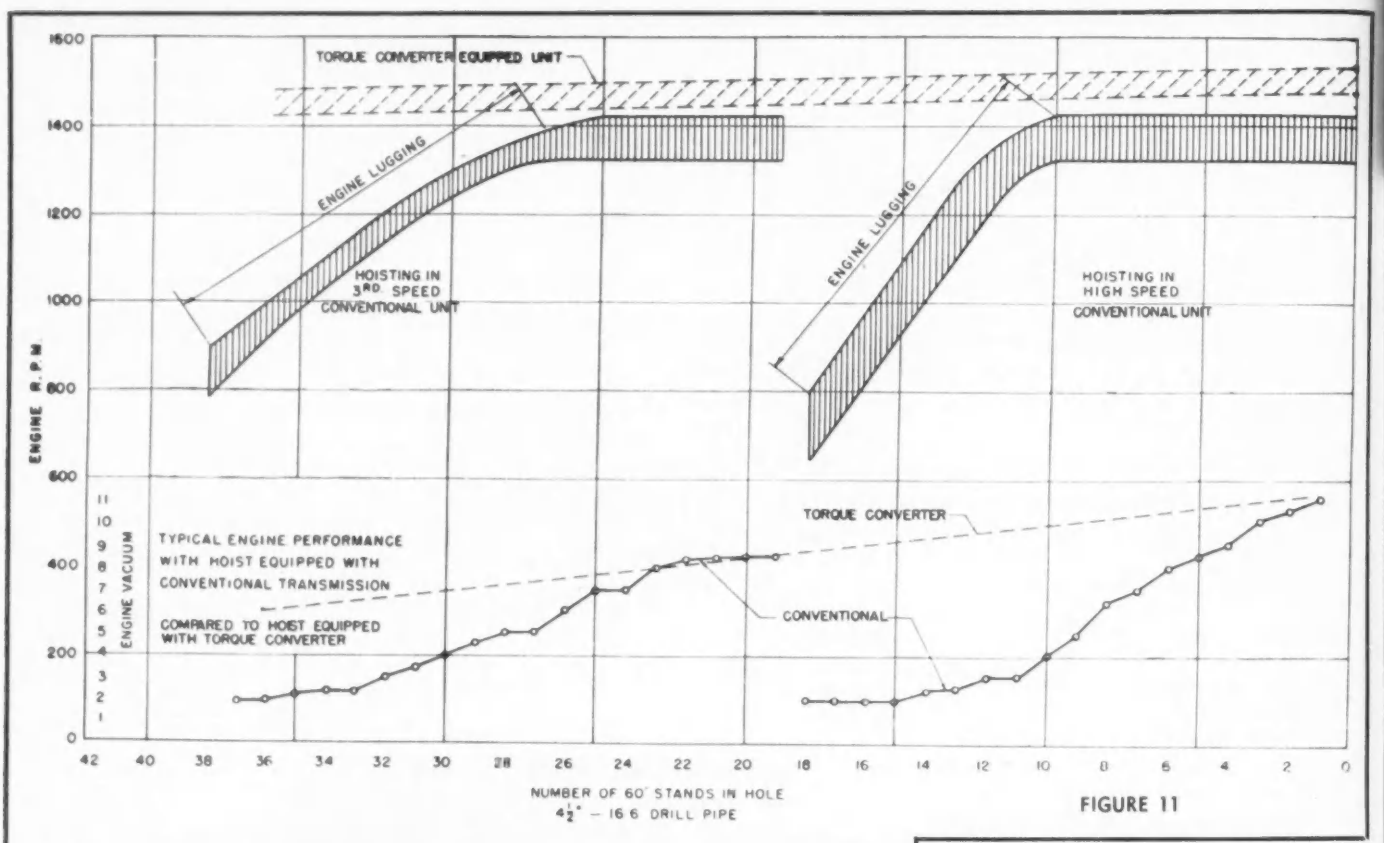
TORQUE CONVERTER EQUIPPED UNIT
ENGINE LUGGING
HOISTING IN 3RD. SPEED CONVENTIONAL UNIT
ENGINE LUGGING
HOISTING IN HIGH SPEED CONVENTIONAL UNIT
ENGINE R.P.M.
ENGINE VACUUM
TYPICAL ENGINE PERFORMANCE WITH HOIST EQUIPPED WITH CONVENTIONAL TRANSMISSION
COMPARED TO HOIST EQUIPPED WITH TORQUE CONVERTER
TORQUE CONVERTER
CONVENTIONAL
NUMBER OF 60' STANDS IN HOLE
4½" — 16.6 DRILL PIPE

FIGURE 11

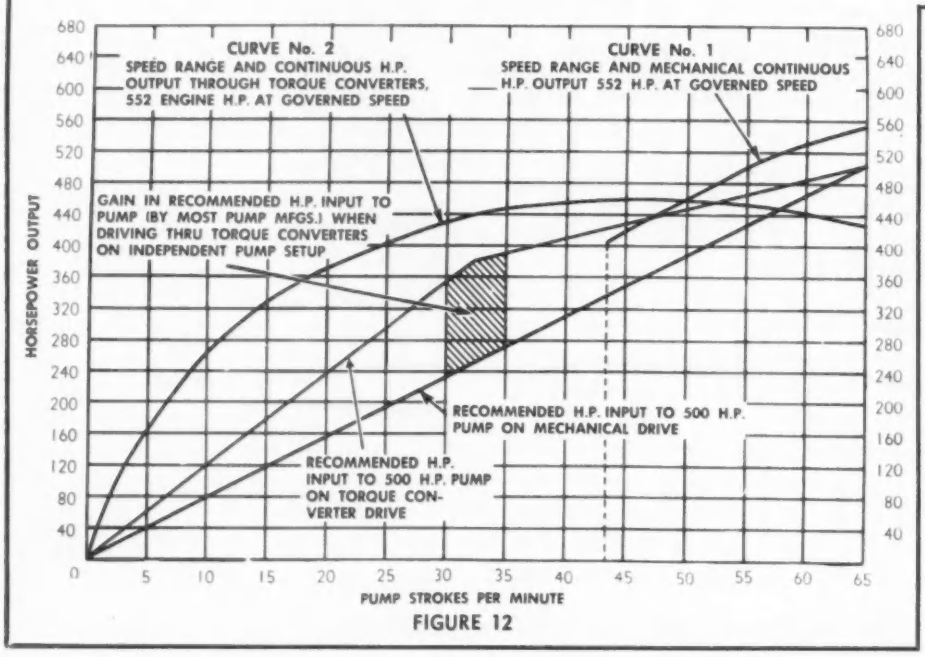
CURVE No. 2
SPEED RANGE AND CONTINUOUS H.P. OUTPUT THROUGH TORQUE CONVERTERS, 552 ENGINE H.P. AT GOVERNED SPEED
CURVE No. 1
SPEED RANGE AND MECHANICAL CONTINUOUS H.P. OUTPUT 552 H.P. AT GOVERNED SPEED
GAIN IN RECOMMENDED H.P. INPUT TO PUMP (BY MOST PUMP MFGS.) WHEN DRIVING THRU TORQUE CONVERTERS ON INDEPENDENT PUMP SETUP
RECOMMENDED H.P. INPUT TO 500 H.P. PUMP ON MECHANICAL DRIVE
RECOMMENDED H.P. INPUT TO 500 H.P. PUMP ON TORQUE CONVERTER DRIVE
HORSEPOWER OUTPUT
PUMP STROKES PER MINUTE

FIGURE 12

shows the speed of the engines on the two rigs during the tests.[2] The engine on the mechanical rig was lugging during a great part of the operation and never attained the revolutions-per-minute of the torque-converter-equipped engine. When the throttle is opened on a converter equipped engine regardless of the load, the engine will come up to speed in less than one second. This is true of the 900 RPM engines as well as the higher speed engines. The power is immediately available. Note also that the vacuum on the engine with the converter never dropped below six inches whereas the other was operating mostly at less than six inches. This explains partially why longer engine life may be expected when converters are used.

It has proved advantageous to drive the mud pump through a torque converter as the pump has a tendency to adapt itself to the characteristics of the pumping system. Peak pressures and peak stresses are decreased by the converter. Like a boxer, it rolls with the punch. Likewise, the ability of the torque converter to apply high torque regardless of output speed without decrease in engine speed enables the pump to have a useable speed range from its rated SPM to stall. Therefore, the operator is able to reduce the number of liner changes to as little as ½ or ⅓ that normally required with a mechanical drive.

Figure 12 shows the difference in performance of the slush pump driven with and without converters. The mechanically driven pump, curve number one, has a maximum speed range of 43 to 65 SPM corresponding to engine speeds in this case of 1200 to 1800 RPM. It is necessary to change liners when the engine speed has been pulled down because the engine is not developing sufficient power. On the converter driven pump, curve number two, the power input to the pump is being maintained over a much wider range because the engines are running at high speeds, and the liner changes are not necessary.

In a recent investigation it was brought out that the pressure pulsations of a power pump are a function of the rate of change of fluid flow or pump speed and that the hydraulic torque converter makes possible slower speed operation while retaining the same size liner at greater depths. The tests conducted showed that for a particular situation, by use of the converter, the pressure pulsations

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were reduced by 50 percent. The resulting analysis determined that an increase of 25 percent could be made in the rated fluid end pressure.[3]

The ability of a torque converter driven pump to stall under pressure is an aid in several drilling operations such as casing tests and squeeze jobs. Being able to maintain a pressure while working the pipe in order to free a plugged bit or to break circulation is also an obvious advantage.

With the rapid advancement of the application of torque converters to drilling machinery, converter manufacturers have continued to develop additional models until today it can be said that there are converters available for most makes and type of commonly used oil well drilling engines. The simplicity of design inherent in a torque converter rig enables the rig manufacturer to place such a rig on the market at a price competitive with or in some instances even less than its mechanical equivalent.

REFERENCES

[1] "Going to Work with Hydraulic Transmissions" by R. M. Schaefer, Allison Division, General Motors Corp.

[2] "Hydraulic Drives in the Oil Fields" by Nicholas A. D'Arcy, Jr.

[3] "Investigation of Torque Converter Drives on Mud Pumps" by David F. Toomey and Ernest G. Chilton, Shell Oil Co., presented before API Pacific Coast District, May 1951.

About the Author

M. L. COOPER, Technical Service Department, Ideco Division, was graduated from the U. S. Naval Academy in 1938. Following graduation he was employed in various engineering capacities by the Tide Water Associated Oil Company and the Richfield Corporation. In 1946 Cooper joined Ideco as sales engineer and has since been active in equipment design and service throughout California, the Mid-Continent area as well as South America and Europe. The past several years have found Cooper devoting a large portion of time toward the efficient and flexible unitization of torque converters in conjunction with oil field equipment.

Cost Accounting for Contractors

CONTINUED FROM PAGE 153

allocated to individual contracts on an equitable basis. The most common basis used is operating days. Any allocation rate should be recomputed and revised periodically as called for by changing conditions or other factors.

A few more troublesome items of cost follow:

OVERTIME PREMIUM PAY. Allocation of overtime premium pay is a factor in arriving at accurate contract costs. In many instances, wells are completed during a payroll week and the rig moved or skidded to a new location and drilling operations resumed. Premium pay for that week should not be charged to the well being drilled at the end of the payroll week, but should be prorated to both wells based on the number of hours worked. In the case of shallow wells which require a relatively small number of actual drilling days, the charging of premium pay for a payroll week to the well being drilled at the end of the payroll week will distort the costs by contract and will render the cost statement prepared for such contract useless in the review of operations and as a basis for future bids.

REPAIRS AND MAINTENANCE. The intelligent accounting for repairs and maintenance of drilling equipment requires segregation of normal repairs and major overhauls. Field personnel must exercise their best judgment in advising the accounting department of the proper classification of each charge. Normal repairs, those that are not attributable to a series of wells, should be charged to the well being drilled at the time of the repair. Major overhauls of equipment should be allocated to the various wells to which the repairs are attributable.

It is often argued that it is impossible to charge a well a fair proportion of rig overhaul costs, inasmuch as the actual expenditures for the overhaul may not be incurred until after completion of the well. It is fairly easy, however, to determine from past experience a rate per day or a rate per foot drilled whereby, through the use of clearing accounts or reserve accruals, the cost of major overhauls can be allocated equitably to the wells as they are being drilled. When the actual overhaul is made, the cost thereof will be charged to the clearing account or reserve wherein the provision was made.

DEPRECIATION. The allocation of depreciation to each contract is important in arriving at well costs. Depreciation applicable to service departments should be charged to such departments and then cleared to specific contracts on a usage basis or allocated along with other overhead items. Depreciation of drilling equipment should be charged to well costs on a usage basis. There are many ways to allocate depreciation and the individual problems of each drilling contractor must be thoroughly reviewed to determine the most correct and realistic allocation method. From a sound accounting standpoint, depreciation based on actual cost should be used in preparing financial statements showing the results of drilling operations.

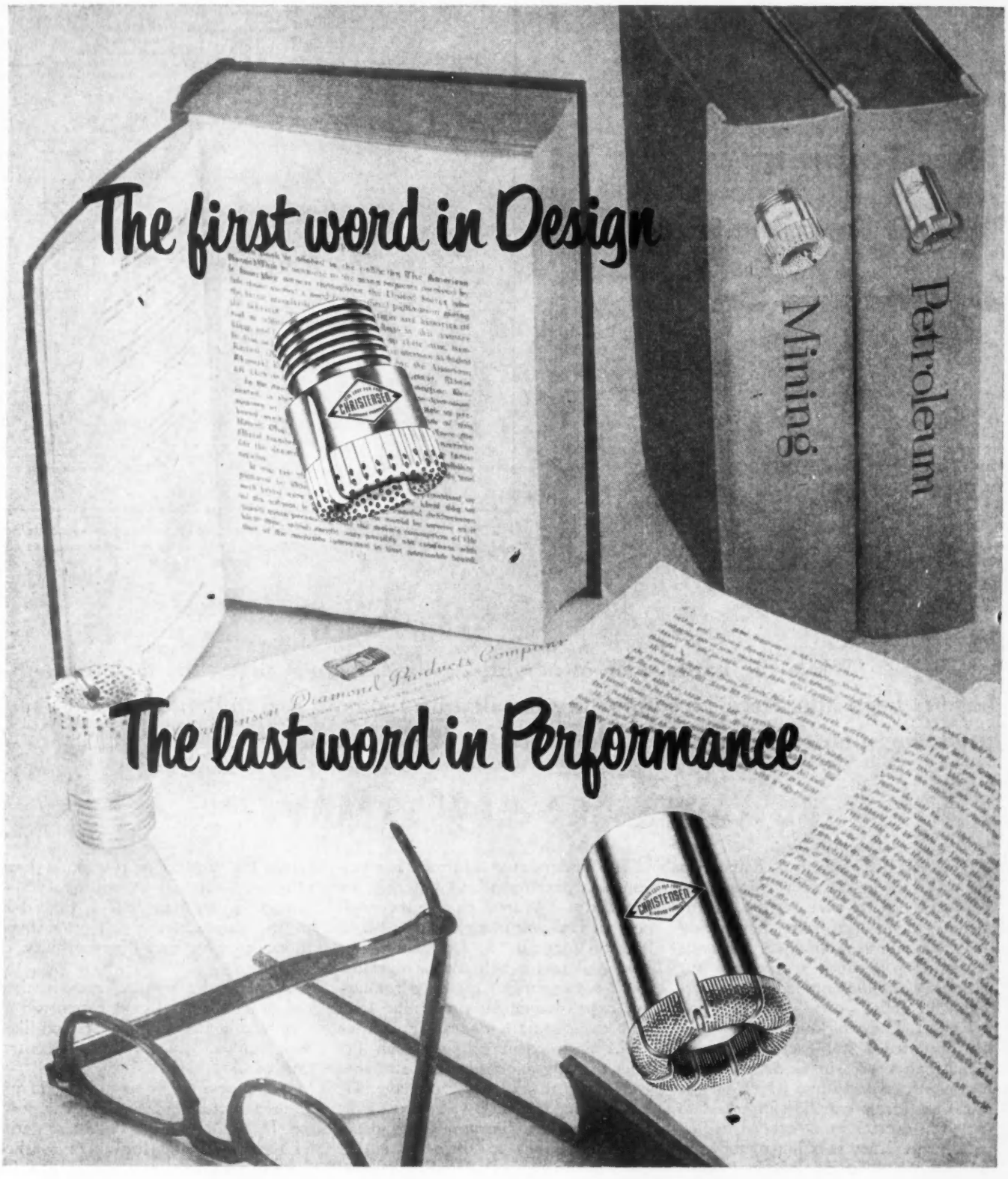
INDIRECT AND OVERHEAD COSTS. Allocation of indirect and overhead costs to wells should be made through the use of clearing accounts. The use of such accounts does not disturb original charges and such procedure facilitates the preparation of financial statements, account analysis, and other accounting and auditing work.

•

Each drilling contractor, depending on the type and location of his operations, has individual problems which must be solved before his accounting system will function properly and provide timely and accurate cost data on each contract. The importance of reliable cost analyses cannot be overemphasized. While the problems and preferences of the individual contractor admittedly may vary, it is believed that careful consideration of the procedures outlined herein will be helpful to those interested in more accurate cost accounting for the drilling industry.

About the Author

F. H. ROUSEY is a supervisory accountant with the Tulsa office of Arthur Young & Company. He has been with this firm since 1945, except for a two-year period when he was chief accountant for Loffland Brothers, Tulsa.



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New Techniques Await Resumption Of Offshore Drilling

By ANTHONY GIBBON
WORLD OIL Staff

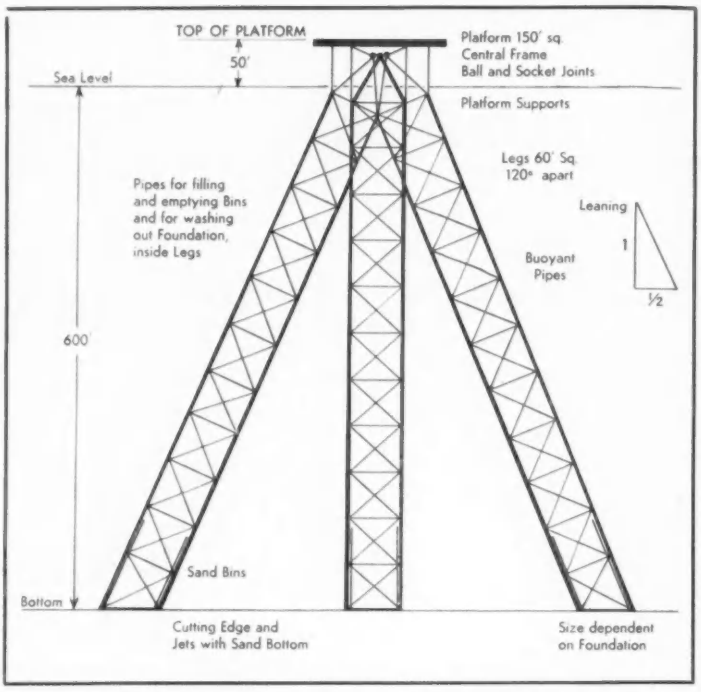

FIGURE 1. Tripod or stable support for mounting platform on which derrick and other drilling equipment are placed. Designed to drill in as much as 600 feet of water.

While the battle over ownership of the tidelands rages, the technicians haven't been idle. Here's a supporting installation for both drilling and producing that can be salvaged when location is abandoned.

WHILE Congress makes up its mind concerning tidelands ownership, technicians have been busy developing new and more economical methods for drilling in deep water and for gathering and loading oil from underwater oil wells.

Robert Lacy of Baltimore, Md., has patented a stable metal support which can be set in as deep as 600 feet of water and upon which one or more platforms can be supported to carry a derrick and other drilling equipment. Lacy is a life member of the American Society of Civil Engineers and has had many years experience in designing and building steel structures. He developed the stable, but removable support, to offset the tremendous costs involved in erecting fixed platforms currently capable of drilling in about 60 feet of water, only. He believes his self supporting, removable tripod will be far more economical than conventional pile supported drilling platforms and much safer in open waters.

The underwater oil gathering system was developed and patented by Richard G. Watts, petroleum engineer of Dallas and rights assigned to Socony-Vacuum Oil Company. The principal factor behind the development is to shortcut the need for laying expensive underwater pipe lines and to eliminate erecting storage tanks mounted on pilings which, besides proving expensive, are also subject to storm and wave damage. He has provided an underwater oil storage tank which is economical to install and impervious to surface weather hazards.

Portable Platform Supports For Deep Drilling: The supports consist of structural legs of great strength, either buoyant or supported, and are hinged or jointed at their tops to a stout frame which is held at the desired location and height above water.

The lower ends of the legs, which are provided with ballast bins, are sunk slowly until they are well grounded, their feet being sunk into a soft bottom by means of fixed wash pipes. Or they may rest on a hard bottom. Sufficient ballast material—sand or other material—is placed in the bottom bins through other fixed pipes, to prevent any possibility of slipping.

A platform or platforms is then constructed on columns supported by footings on the inclined (tripod-like) legs, and mounted on the central frame.

The supports may be removed from the sea bottom by reversing the process, the sand or other ballast material in the bins being sucked or washed out by means of pipes provided for that purpose.

Changes in depths at a new location can be provided for by putting in or taking out sections in the middle of the legs.

The above are the essentials of the invention which in design and construction can be varied in many details. Below is described a preferred design and method of construction.

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site to determine approximately at the location of each leg, the elevation of suitable foundation material, its bearing power and angle of friction. With this information, the design of the legs are undertaken.

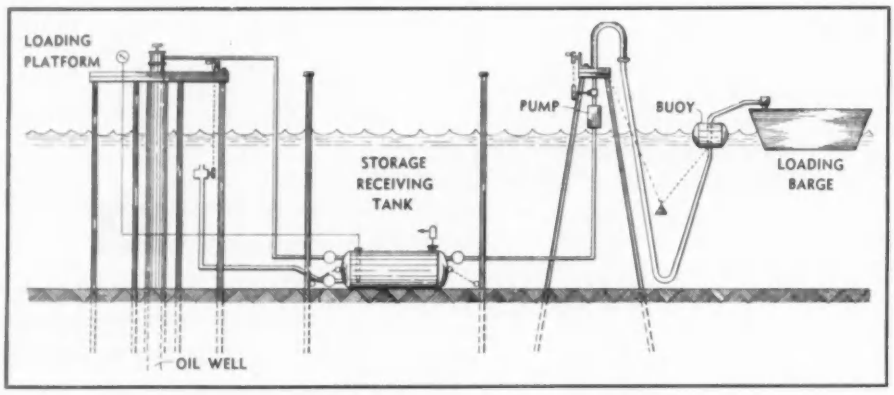


FIGURE 2. System for gathering and loading oil from underwater oil wells.

For convenience in handling at sea buoyant legs of watertight steel or iron are chosen. The number of legs may be more than three, but a tripod is chosen in this description, with each leg on a slope at one half horizontal to one vertical (Figure 1). The legs may be made of three or more columns strongly braced together with structural shapes or with buoyant pipes. When it is considered that a steel pipe of 12-inch diameter and ⅜-inch in thickness will easily float in fresh water with the ends sealed, and that a similar 36-inch diameter pipe will float almost half out of water, it is evident that a wide range of design is possible.

Pipe used in the columns are made watertight by welding and are braced. The portions of legs above water should be as small in cross section as is safe in order to reduce the force of wave action. The legs should be designed with ample strength to act as beams of about 600 feet span and as leaning columns bearing the weight of the platform and equipment on it, its own weight and bin material, and to withstand the forces of winds and waves.

Near both the lower and upper ends of the legs heavy pulley blocks with large sheaves, preferably of bronze, should be fastened with lead lines to the top, for the purpose of lifting the legs with heavy tackle if necessary.

Tops of the columns are close together in symmetrical arrangement, each leg supporting a large bronze ball which fits into a bronze socket on the central frame. The central frame joins and ties the leg tops together as well as the platform.

Legs 725 feet long and 60 feet square can be built on wooden barges in quiet water, towed to sea on the two end barges which are sunk from under the leg and recovered. The legs are towed or pushed to the three sides of a special wooden scow which has a central column of the necessary height, on which the heavy central frame is placed by a derrick boat and securely fastened.

The upper end of a leg is then raised by a derrick boat and the ball put into the socket. The three legs are joined to the frame, the lower ends held by derrick lines which prevent the leg from revolving, swinging from the 120-degree angle, or going down too fast when beginning to load the bins with ballast. The first weight of ballast may be placed in the bin through a tube from the derrick boat.

When the legs are grounded the wash pipes can be operated from pumps on the derrick boat, washing out material from one or more sides. After bedding the feet of the legs and bolting the upper socket guards in place, the bins should be loaded with an adequate weight of ballast to withstand all surge of the sea.

Following the above technique the stable support is now complete and ready for the columns, girders, platform, derrick and other drilling equipment.

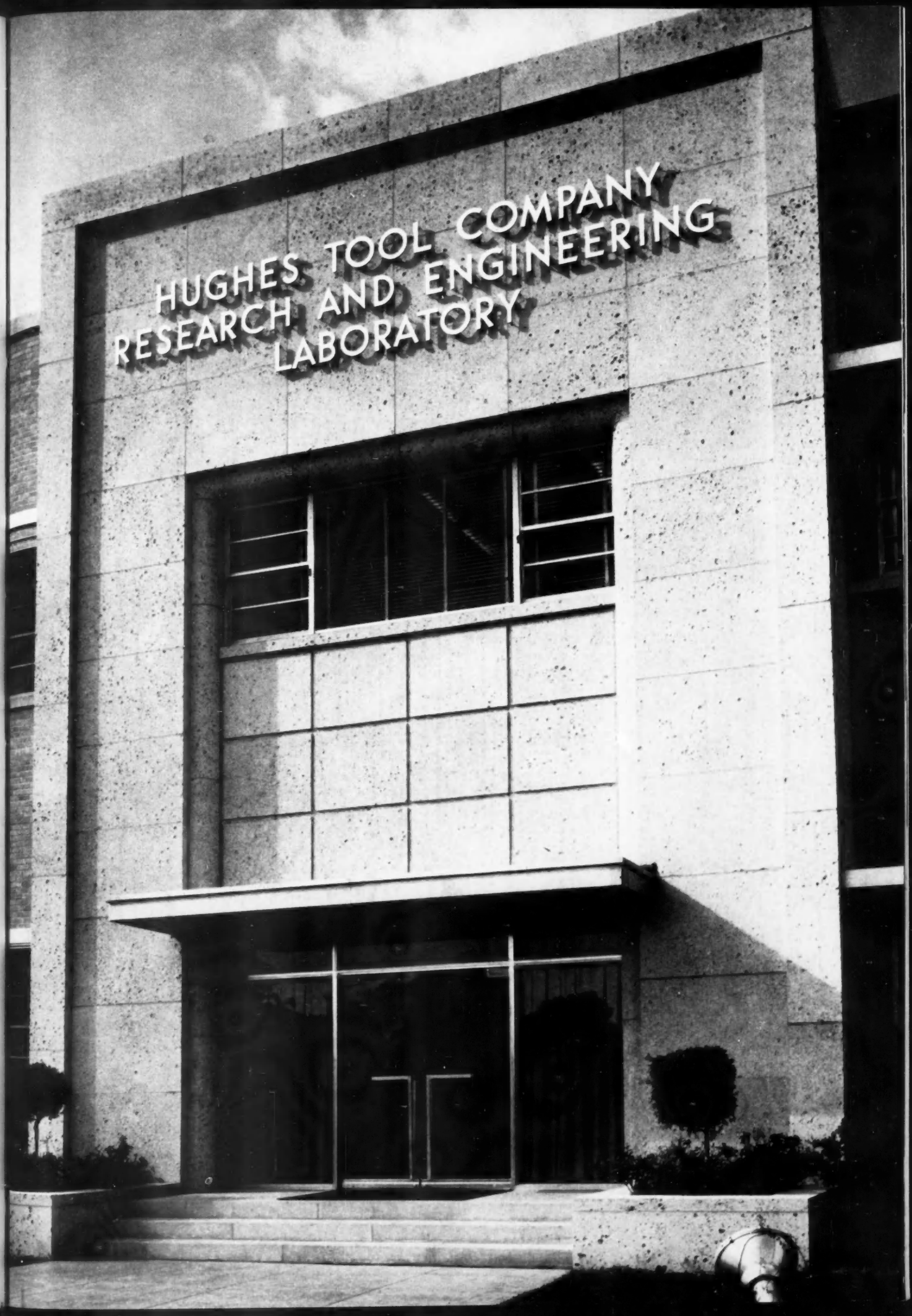
The platform is made of deep girders, beams, and stringers, and has an open floor, in which a well at center may contain the rotary table, with access to it beneath from a lower platform, which is reached through side openings in the top or main platform. A temporary platform can be built near the top of a leg when it is first constructed, and after the legs are in position, a crane or other equipment can be placed on it to complete the platform and to erect the derrick with its legs secured to the heavy girders or to the tripod legs.

Underwater Oil-Gathering System: The system for gathering and loading oil from an underwater oil well compromises a combination producing platform set on piles, a wellhead on the platform and a storage tank positioned underwater adjacent to the platform at a sufficient depth to be unaffected by surface winds and waves (Figure 2). It provides an oil transfer line connecting the well to the storage tank, a check valve to prevent the flow of fluid from the storage tank to the wellhead and a line to the storage tank open to the surrounding water. This line is provided with a check valve permitting the flow of water through the line to and from the storage tank but preventing the flow of oil through the line from the tank.

The oil is gathered from the underwater well and stored in the tank which is full of liquid at all times, either oil, water, or oil and water, and ballast, if required, to overcome buoyancy. An oil transport barge can be utilized as the storage tank when sunk to an underwater position. If desired, the tank may be positioned intermediate to the bottom and the surface, but in this case it must be securely anchored to the sea bottom.

Oil from the well passes into the storage tank through the oil inlet line at a pressure in excess of the hydrostatic pressure of the surrounding water, displacing the water in the tank. A pump may be used to boost the pressure if well pressure is less than the hydrostatic pressure. The displaced oil leaves the storage tank through a water line located at the bottom of the tank. This line is equipped with a check valve actuated by change in the specific gravity of the liquid passing through so as to close the line and prevent loss of oil when all the water has been displaced. The oil outlet line is also provided with a check valve to prevent water from backing up into the well. As a safety measure the tank is provided with a pressure operated valve which opens automatically if excessive pressures develop within the tank.

Oil is removed from the tank through an oil outlet line supported by a mooring dolphin, and into the transport barge. Where the tank is at a sufficient depth the oil will flow into the barge, but a pump should be installed for quicker loading of the barge. During this operation water enters the tank displacing the oil being loaded, either through the same or through a separate line. This oil outlet is also provided with a check valve to prevent flow of water into the barge when all the oil has been removed or displaced from the underwater storage tank.


HUGHES TOOL COMPANY
RESEARCH AND ENGINEERING
LABORATORY

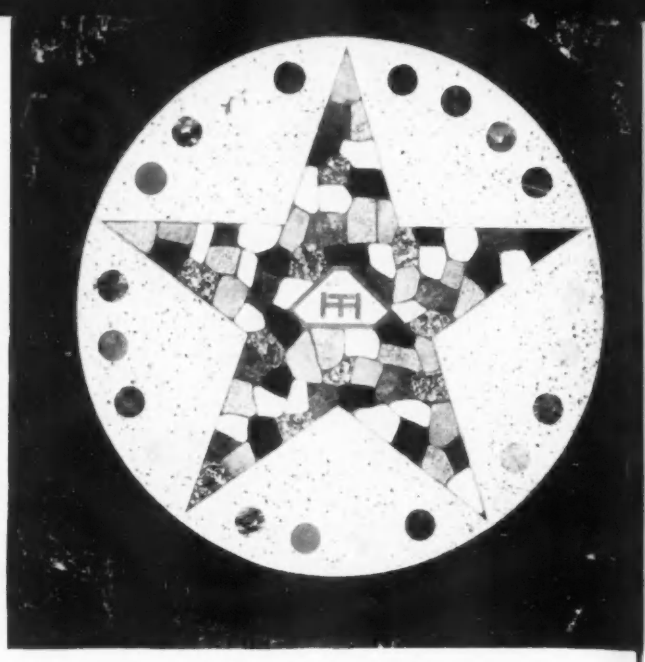
NEW HUGHES LABORATORY EXPANDS SCOPE OF DRILLING RESEARCH

The facilities of its new Research and Engineering Laboratory will enable the Hughes Tool Company to broaden the scope of its engineering activities related to the development of improved drilling tools.

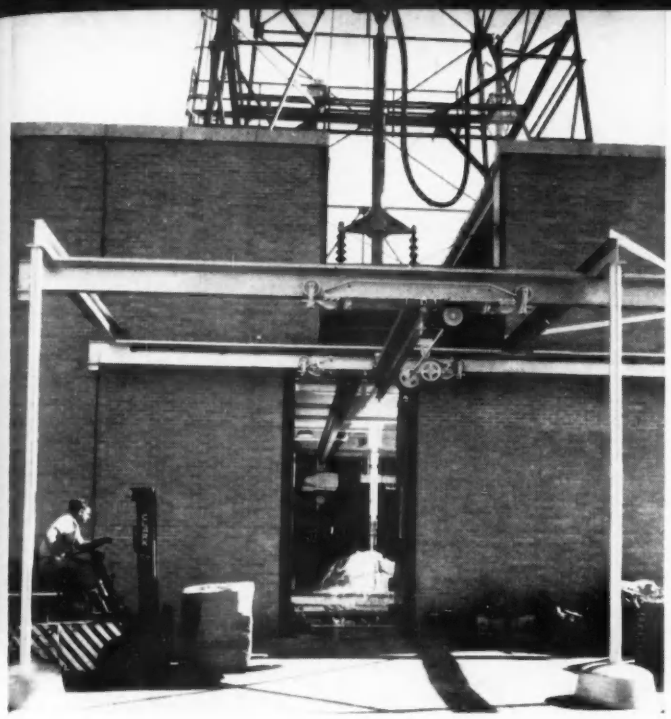
The new Laboratory is an "Engineering Pilot Plant" where Research, Product and Metallurgical Engineering plans and ideas are converted into reality.

Six laboratory sections and a modern machine shop are housed in the Research and Engineering Laboratory building. These are: Drilling, Product and Product Part Mechanical Testing, Metallographic, Chemical, Heat Treating, and Welding. The building is of brick and stone construction and is 325 ft. long, 120 ft. deep with a two-story center section. The total floor area is approximately 60,000 sq. ft.

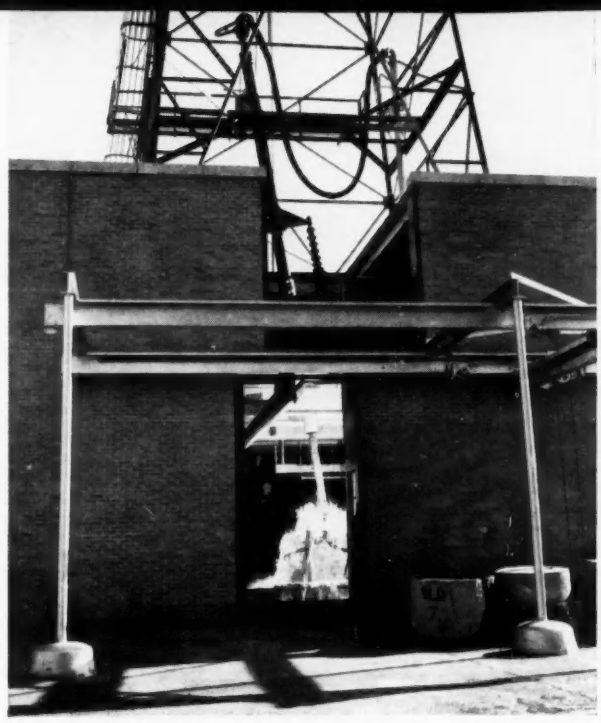
Research, of course, is not new at Hughes. The industry's and world's first "drilling research laboratory" — to study the performance of rock bits — was established by Howard R. Hughes, Sr., in 1910. In recent years the laboratory facilities have been repeatedly expanded, culminating in the building of the new laboratory, regarded as the finest of its kind, devoted to the drilling industry.



The decorative star-shaped insert in the center of the lobby floor is an arrangement of rock pieces from formations used for drilling tests by the Laboratory. The 20 round pieces between the points of the five-foot star are sections of cores obtained from major oil producing areas of the United States.



In this view of the drilling rig are shown derrick, swivel, drill stem, "V" window, hydraulic pulldown yoke for applying load on the bit, and "cellar" — the laboratory room in which test blocks are drilled. The derrick rising above the Laboratory roof is 118 ft. tall.



Inclined drilling is one of the many special investigations carried on with the Laboratory drilling rig. In these tests the drill stem can be inclined as much as 10 degrees. This type of experimental drilling has furnished valuable information relative to the problem of straightening crooked holes.

FIELD-SIZE DRILLING RIG USED IN LABORATORY DRILLING

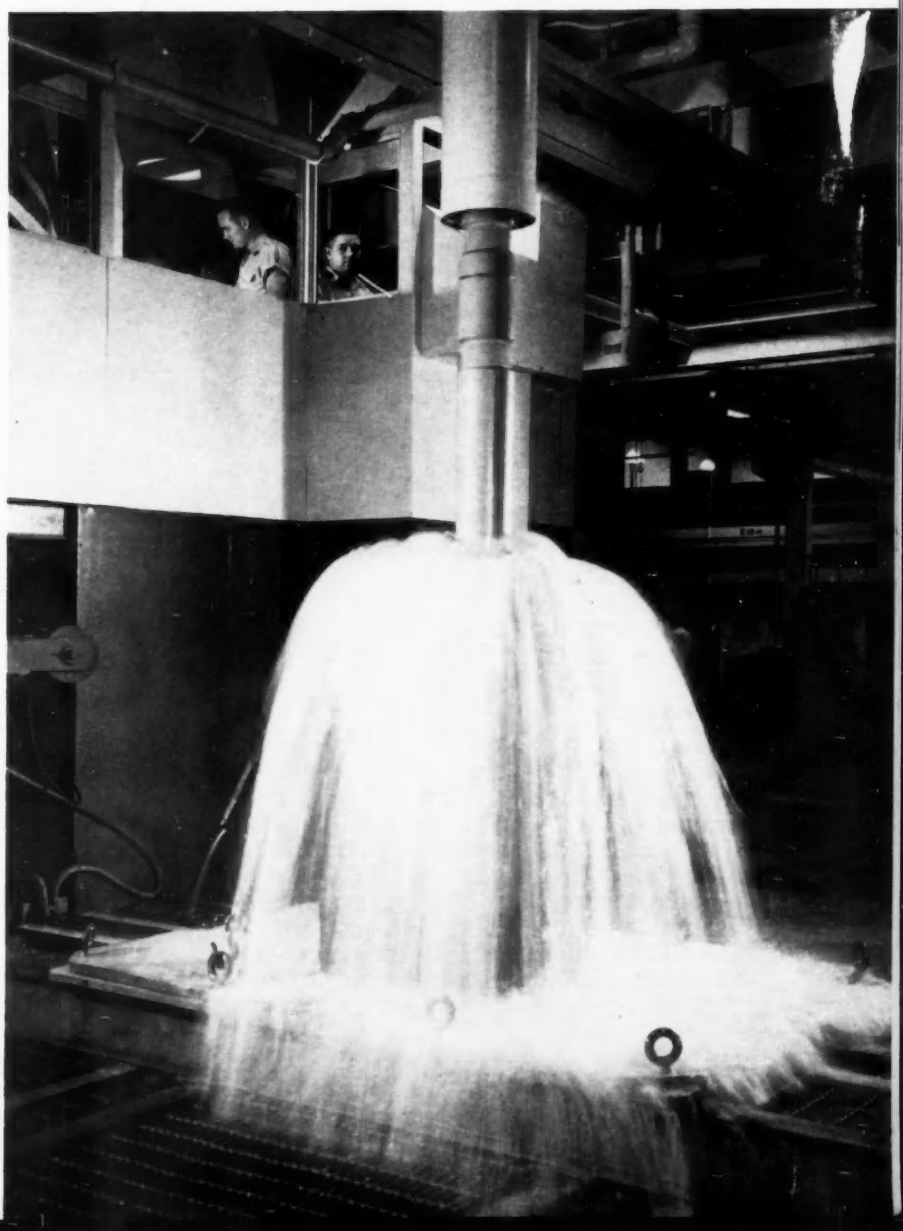
The fundamental purpose of all Hughes rock bit research is to improve rock bit performance.

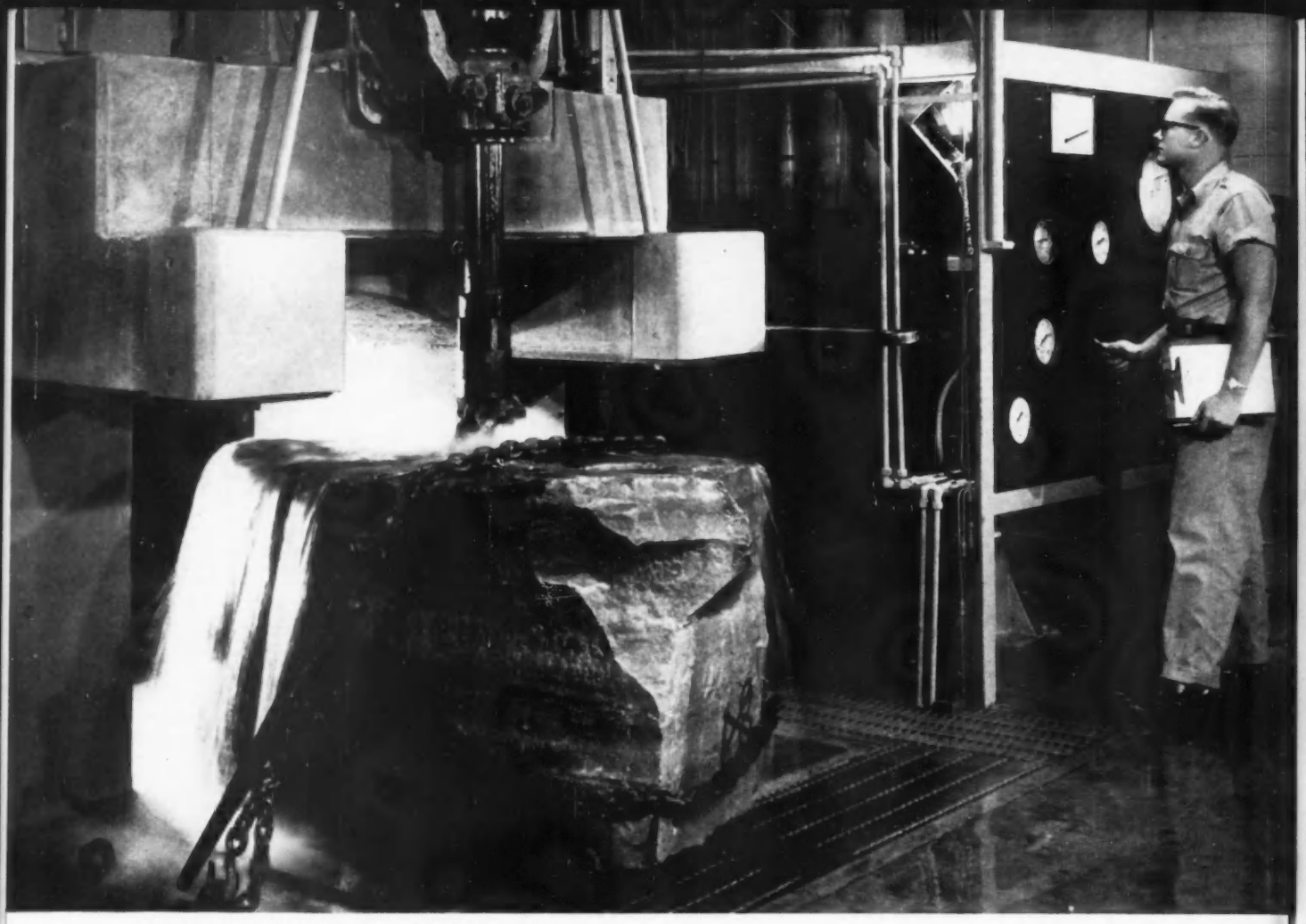
In attaining this improvement it is necessary to balance design with the application of correct metallurgical materials and processes.

The preliminary proving ground is the Drilling Laboratory housed within the main Laboratory building. Its field-size drilling rig, with 118 ft. derrick, was specially designed to test rock bits in a manner simulating oil field drilling conditions. Variable drilling loads as high as 100,000 lbs. can be applied to the bit with rotational speeds up to 400 R.P.M.

Test blocks of rock, used in these drilling tests, are taken from many states throughout the country and are selected to approximate the drillability of formations encountered in the various oil fields. These test blocks are used to evaluate designs, materials and metallurgical processes.

Drilling is controlled by an operator seated in the booth shown above the test block. The rotary table that drives the drill stem is located on the "deck" of the rig at a level corresponding to the working floor of a field rig.



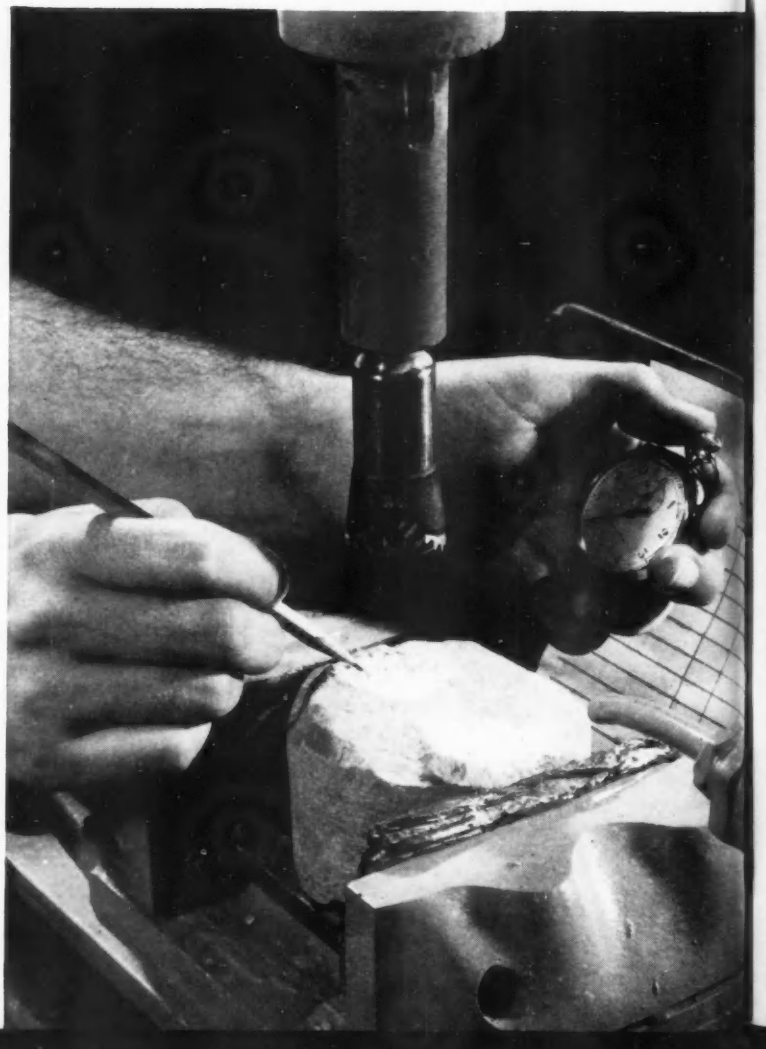


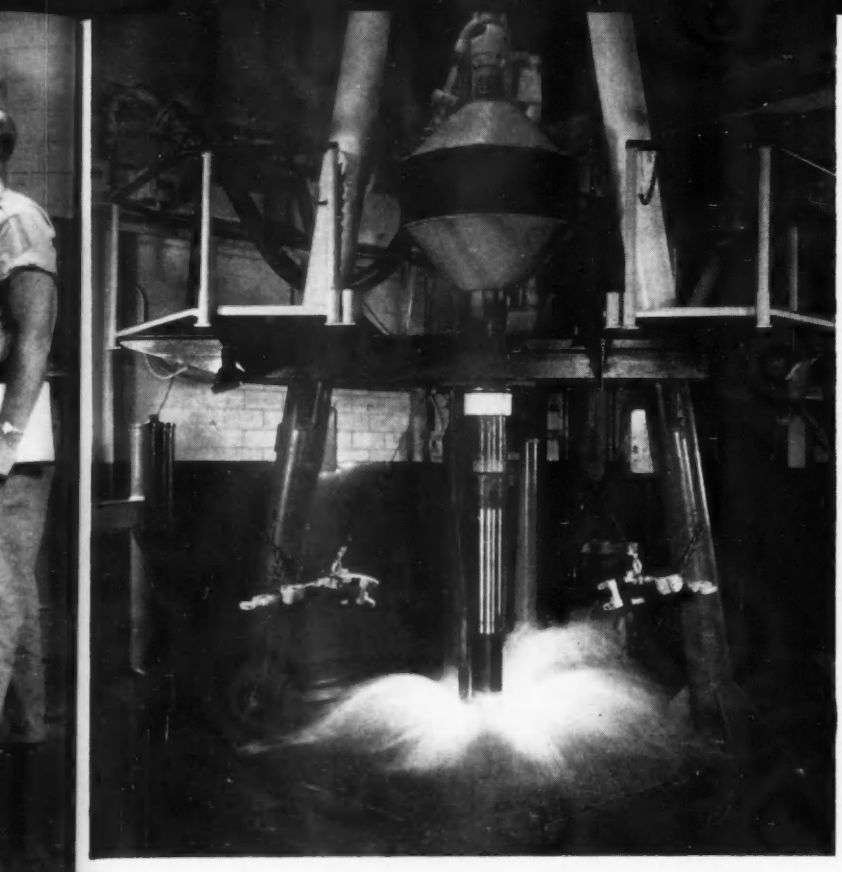
AUXILIARY DRILLING RIG. This small rig is capable of applying loads up to 50,000 lbs., at speeds up to 90 R.P.M. The operator in the above photograph is starting a hard formation drilling test and is studying the readings of a drilling rate indicator. A Hughes development, the indicator tells the operator the actual rate of penetration being made by the bit, instantly indicating every change in progress.

MICROBIT USED IN ESTIMATING ROCK BIT PERFORMANCE

The Microbit shown here is 1¼" in diameter. It is used in drilling cores and rock samples from all parts of the world.

Examination of the data obtained during the microbit drilling gives Hughes engineers information for estimating the performance of full-size bits in the same type of rock formation. The microbit drilling tests provide a good basis for picking the proper type of bit to be used in specific formations and in recommending the operating conditions that will give the best results.





PERCUSSION DRILLING TEST EQUIPMENT

The Drilling Laboratory is equipped to test new drilling techniques as well as new tools. The test equipment shown at the left was designed primarily for use in the development of rotary-type percussion drilling tools and bits.

At the time this photograph was taken a time-displacement diagram was being made to determine the cyclic characteristics of a fluid-actuated percussion tool. The entire "A" frame is supported on a reinforced concrete foundation mounted on large helical springs to reduce vibration.

TESTING HIGH VELOCITY JET BIT

In the development of Hughes jet rock bits emphasis has been placed on high velocity jetting action and bottom hole flow pattern.

The photograph at the left shows a test being conducted to observe the action of various types of jet nozzles.

The pressure drop across the bit and the velocity of the drilling fluid are important factors affecting the penetration rate of the bit. It is necessary that the fluid jets have sufficient velocity to remove the cuttings from bottom and keep the cutters clean.

The pressure assembly at the right in the photograph is used in studying fluid jetting action of individual nozzle outlets on drilling formations.

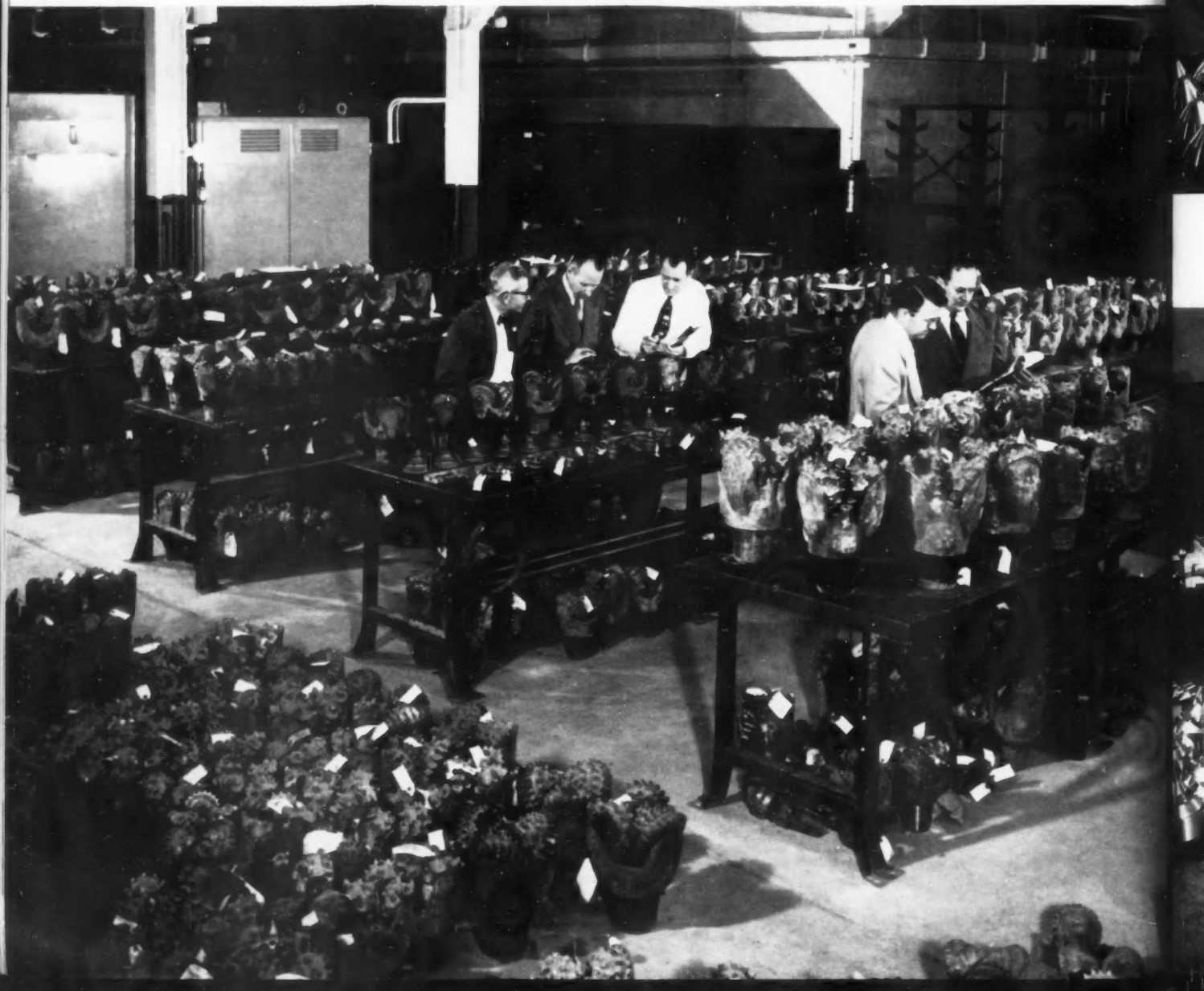
STUDY OF "DULLS" AIDS IN THE ADVANCEMENT OF DESIGN AND METALLURGY

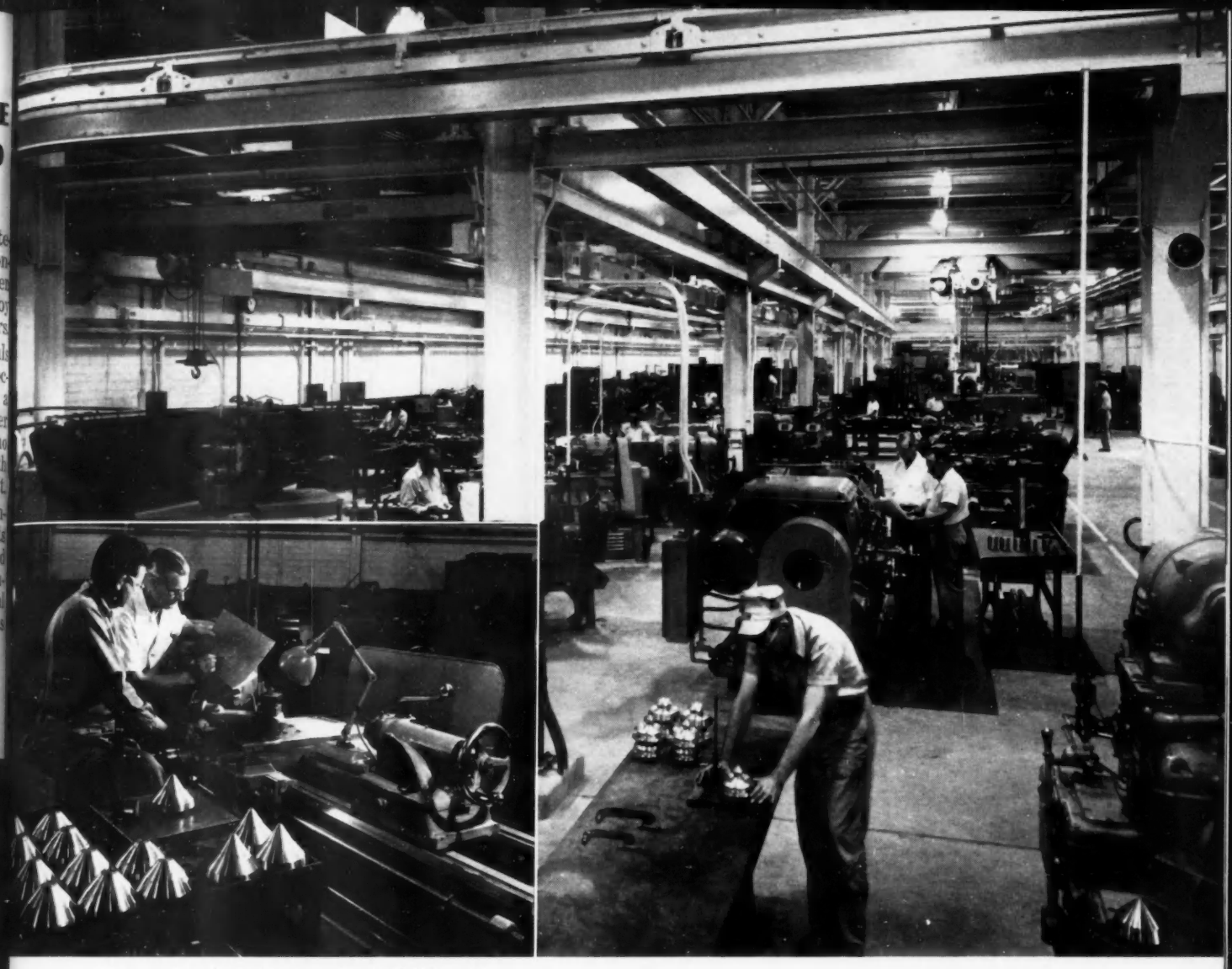
The cycle in the study of new bit designs, materials, and processes of manufacture is not concluded until bits used in the field have been returned to the Laboratory for inspection by Research, Product and Metallurgical Engineers.

Combined with the laboratory tests, field trials predict the performance of new materials, processes, new bit design or a design change in a standard bit. Trial groups of bits are run under the observation of Hughes field engineers who return the "dulls" to the Laboratory along with the complete performance record of each test bit.

Project studies of this type are regularly conducted in many areas on large groups of bits involving several sizes and types. The returned bits are examined externally and then disassembled for a thorough physical and metallurgical study. Information from these sources provides a reliable basis for engineering evaluations.

Section of Laboratory showing Hughes engineers examining returned bits together with their field performance records. This is a continuing study carried on throughout the year.





Above, the shop foreman is explaining to the lathe operator machining details on an experimental cone. Below, teeth are being milled on an experimental cone.

LABORATORY MACHINE SHOP MANUFACTURES TOOLS FOR FIELD TESTS

The Hughes Laboratory Machine Shop is devoted to the building of full-scale test models of rock bits, tool joints and other drilling tools for laboratory and field testing. In connection with the latter, this Shop is equipped to expedite the manufacture of these tools in sufficient quantities for extensive and immediate field trials.

The Machine Shop handles a large amount of work for the Research, Product and Metallurgical Engineering Departments in building new designs, new mechanisms and new devices requisitioned for preliminary testing or other experimental work.

The operator, above, is preparing to remove experimental bit cones from an atmosphere controlled heat treating furnace for quenching.

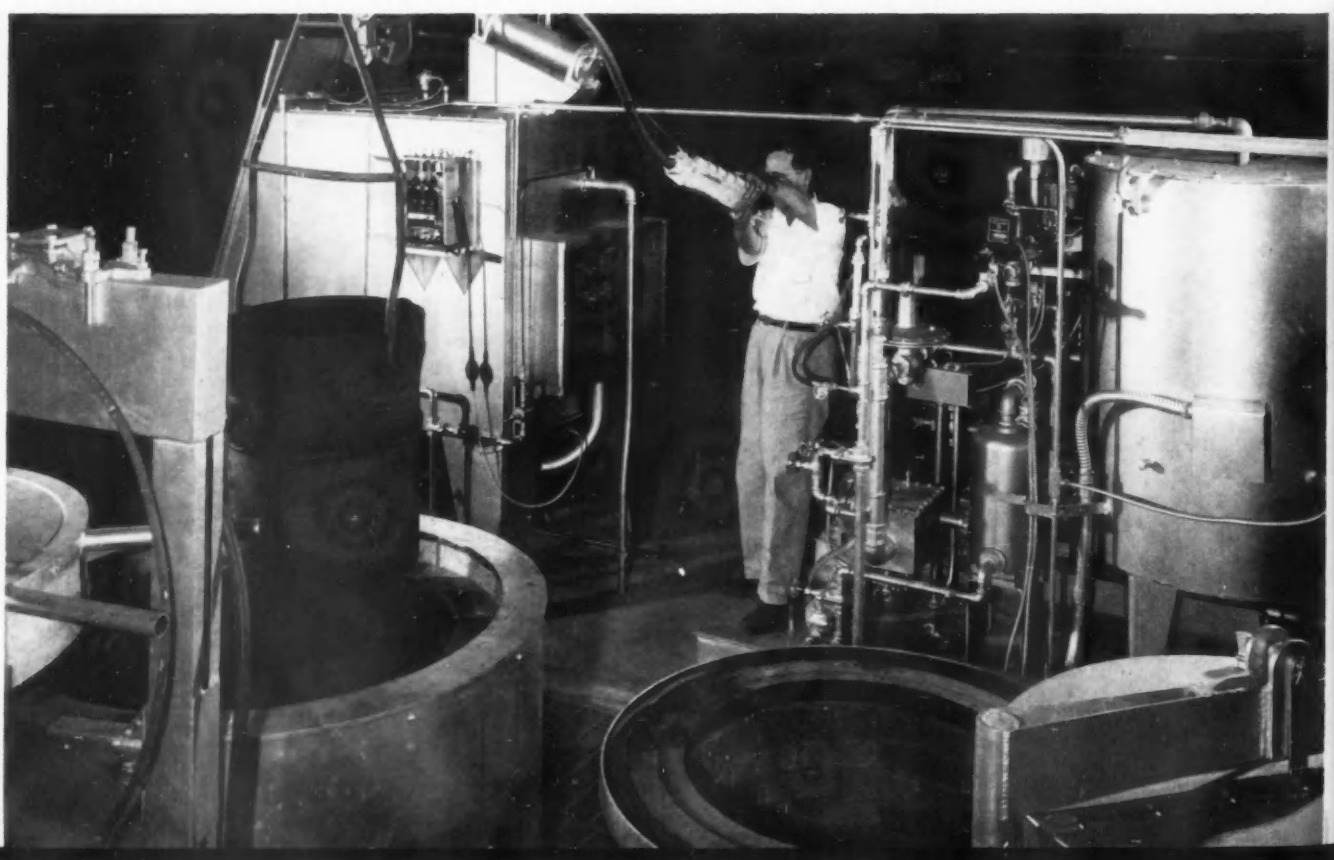
Controllers and temperature recorders for the Laboratory heat treating and carburizing furnaces.

COMPLETE LABORATORY HEAT TREATING FACILITIES

Metallurgy plays a major role in the development of new drilling tools at Hughes and in the improvement of existing tools. As a result, special emphasis has been placed on heat treating, carburizing and atmosphere control equipment in the new Laboratory. These facilities, under the direction of the Metals Group, are used principally for the heat treating and carburizing of experimental products and product parts for laboratory and field testing, and for setting up and maintaining proper controls over metallurgical operations employed in the various production shops in the Hughes plant.

With the Machine Shop to make experimental product parts, together with complete facilities for carburizing, heat treating and other metallurgical processing and the various mechanical and physical testing equipment, valuable technical information can be obtained rapidly and with controlled accuracy.

Technician transferring high temperature pot, loaded with cones, from gas carburizing furnace to slow cooling unit.



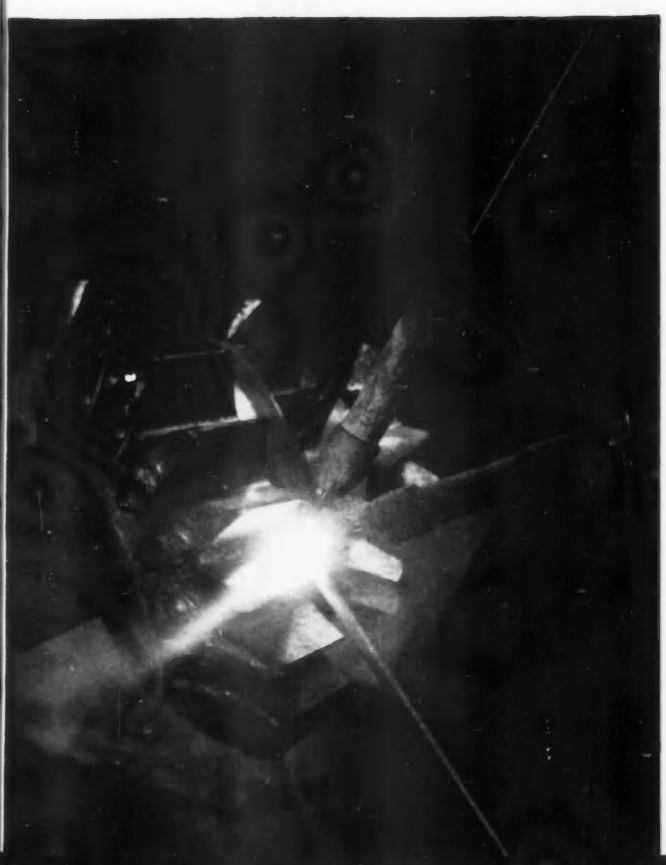
Extent of hard facing and welding facilities is shown in this view of the Welding Laboratory.

Operator applying tube tungsten carbide to the surface of a Hughes "Flash-Weld" tool joint box.

WELDING LABORATORY ADVANCES HARD FACING & WELDING TECHNIQUES

The Hughes Welding Laboratory is equipped to do the hard facing and welding required on experimental tools, conducting investigations of new hard facing materials and techniques, handling the control work on materials and equipment used in shop production welding, hard facing and brazing operations, and carrying on other work normally requiring the use of this type of equipment.

Tube tungsten carbide (Hughesite) is being applied to the teeth of Hughes rock bit cone.



Starting an experimental hard facing job, the welding technician and engineer are selecting required hard facing alloy rods from laboratory-manufactured stock.

Metallurgist prepares for a microstructural examination of a bit tooth section on the metallograph.

The stereoscopic microscope is used to aid visual examination of metal parts where relatively low magnification is desired.

Tukon hardness tester used in measuring Knoop hardness of miscroscopically small areas on finely polished metal specimens.

The hardness of a section of carburized and heat treated Hughes rock bit cone is being measured with a Rockwell hardness tester.

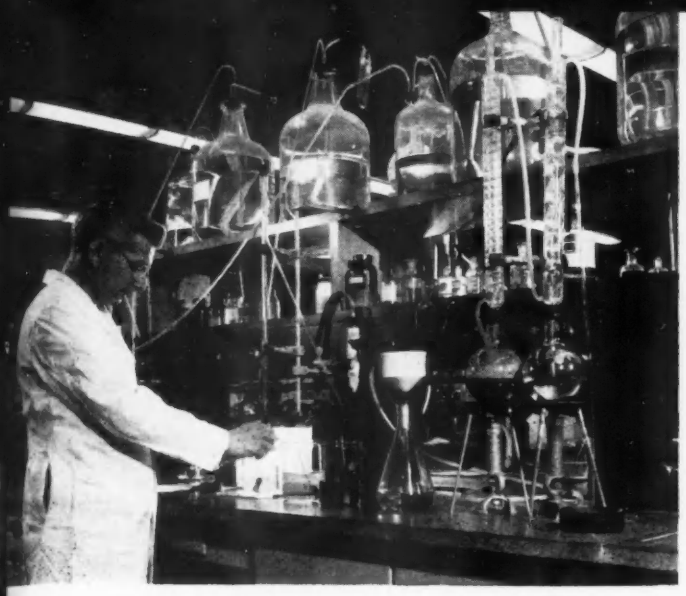
COMPLETELY EQUIPPED METALLOGRAPHIC LABORATORY

The complete array of instruments in the Metallographic Laboratory along with a unique macro-etching installation, designed by the personnel of this group, and a modern, highly efficient dark room arrangement enlarge the scope of work that the Metals Group is prepared to undertake.

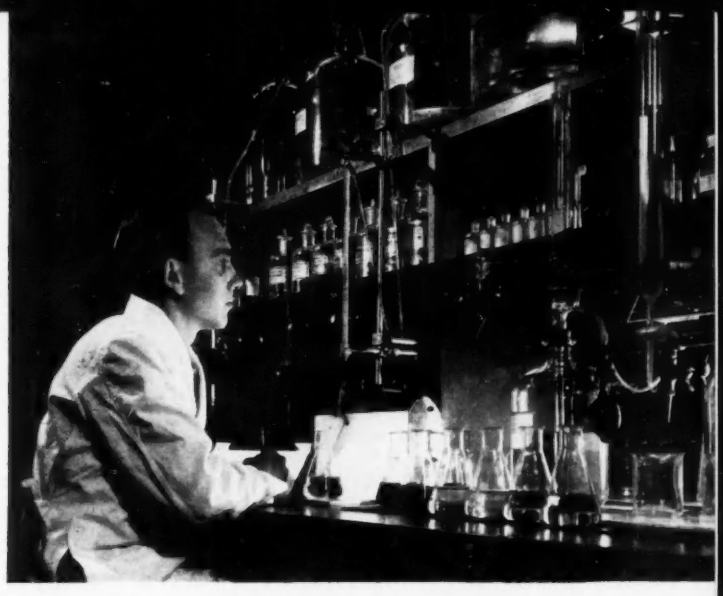
The instruments here include latest types and models for the advanced nature and large volume of metallographic work handled by this group. Special emphasis is placed on the importance of hardness measurements and microstructural studies of extremely hard materials (the diamond substitute types) that play such an important role in oil well drilling.

High speed photography is employed to analyze rock bit drilling action and other rapid motion phenomena.

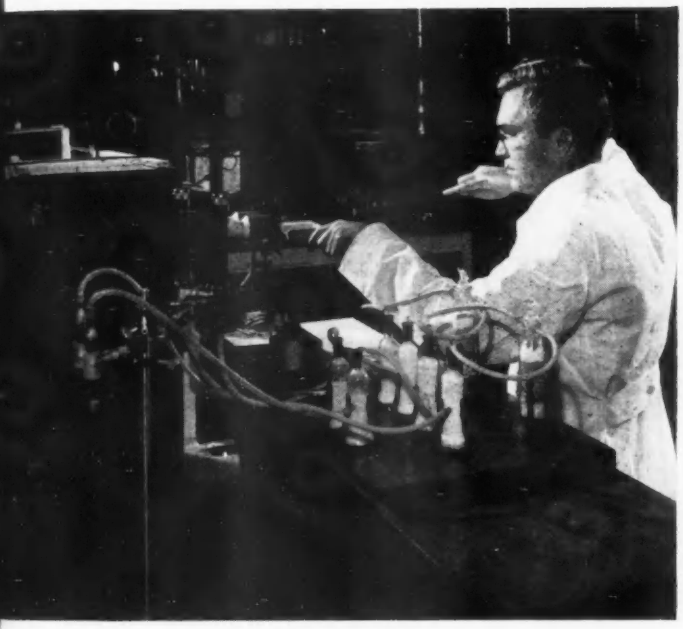
In addition to investigating new materials, and processes, the Hughes Metals Group devotes a substantial part of its time to routine laboratory operations related to metallurgical materials and process controls involved in the Company's manufacturing operations.



Boron analysis is routine step in controlling quality of abrasion-resistant alloys made by Hughes.



The manganese content of a steel sample is being determined in the titration with sodium arsenite.



Combustion type furnaces used for the determination of the carbon content of steel.

General view of the Chemical Laboratory taken during the running of various metal analyses.

CHEMICAL LABORATORY PLAYS IMPORTANT ROLE

The Chemical Laboratory, as set up in the new Research and Engineering Laboratory building, performs a dual role. Its facilities are used to advance the search for new materials to meet the requirements of new products and new uses, and to establish and maintain controls over plant operations.

In the latter capacity, the Laboratory's comprehensive analytical program makes possible the maintenance of high product quality in production carburizing and hardening, as well as the many other metallurgical operations and processes involved in the manufacture of Hughes Tool Company products.

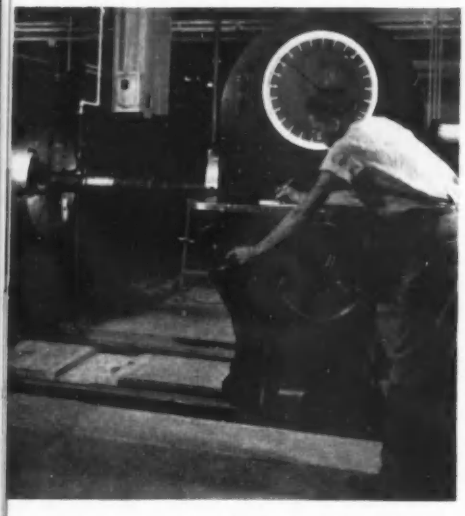
The Laboratory is equipped to handle a wide range of analytical procedures. Among its specialized equipment is the latest type direct-reading spectrometer used for rapid production analyses and for the determination of elements that would be time-consuming under other analytical procedures.

PRODUCT COMPONENTS UNDERGO SEARCHING TESTS IN MECHANICAL TESTING LABORATORY

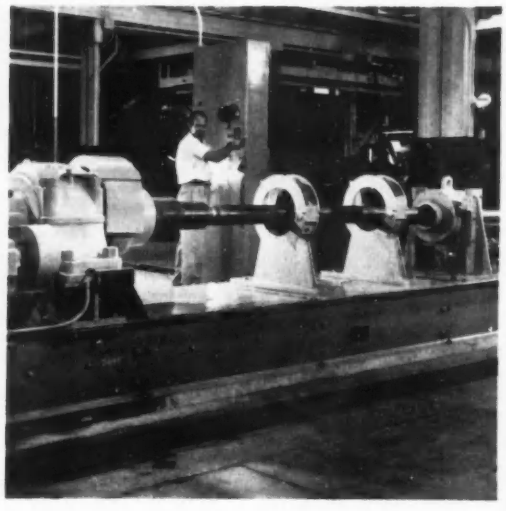
The Mechanical Testing Section and the Project Engineers assigned to this work are largely concerned with testing product parts or product assemblies under conditions simulating oil well drilling. Many of the Laboratory machines are designed by the group to approximate the conditions that will be imposed on the part or assembly in actual service.

The mechanical testing equipment includes a high capacity torque measuring machine, machines for fatigue testing full-size drill stem connections, machines to test resistance to abrasion, and machines designed and built to test antifriction bearings and plain bearings under variable loading and rotational speeds while being flushed with an abrasive-ladened fluid to simulate drilling mud.

The ultimate objective in these specialized tests is to improve the service life of the product by determining the materials and designs that assure the best results.



600,000 pound-inch torque measuring machine used in testing drill stem components such as tool joints, drill collars, drill pipe, pin and box connections and tool joint-to-pipe connections.

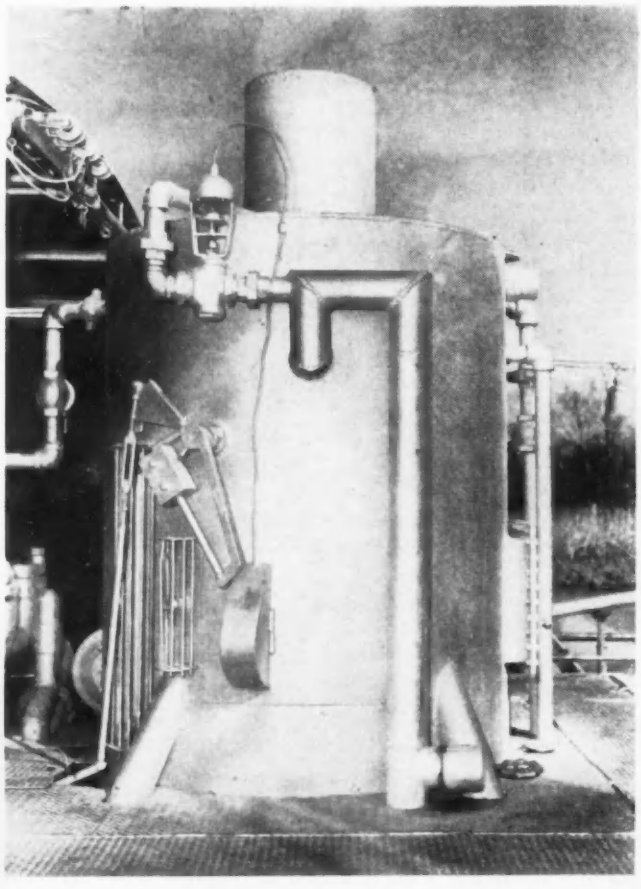


Rotating cantilever beam type fatigue machine used to test tool joint-to-pipe connections. A bending load is applied by an air cylinder that sets up cycles of reverse bending as the specimen rotates.

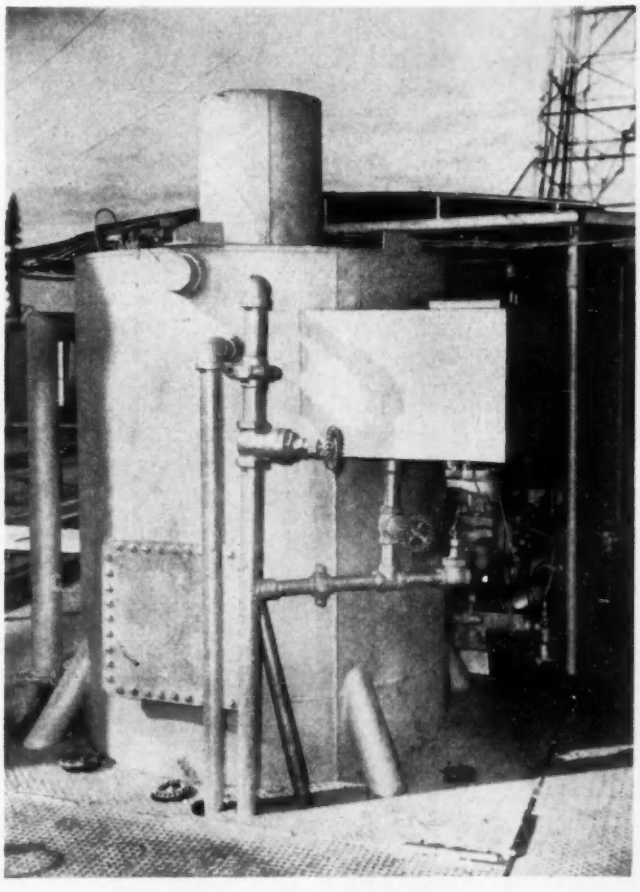
Testing the abrasion resistance of the gage surface of a rock bit cutter.

Bit bearing abrasive wear tests indicate the ability of bearings to stand up under severe drilling conditions.

Pictured below is a portion of the area devoted to specialized mechanical testing.



1. Shop-made automatic controls provide a constant fluid level in preheater system. The lever system, to left of heater tank, actuates cold water pump fluid feed in response to a float movement. Automatic control regulates temperature to a point below level damaging to to pump operation.



2. Bolted inspection plate permits ease in unit servicing. Box attached to tank side stores and feeds treating chemical to the hot water pump. An example of efficient boiler water heating equipment, unit can be fabricated to meet an operator's needs.

How to Unitize Preheater

This operator saved on transportation costs by anchoring preheater to feed unit skid.

FEEDING cold water to a boiler is certainly no way to save money; however, if a preheater is coupled to the steam generating system, a unitization plan should be devised whereby it is attached to other location machinery to reduce transportation costs.

One idea of how the preheater can be unitized with other rig equipment is shown in the accompanying illustrations. By extending the boiler feed unit skid just a few feet, sufficient room is provided for a vertical boiler feed heater.

Exhaust Steam Utilized. This particular unit will satisfy the heating requirements for feeding hot water to four or five 150-horsepower, locomotive type boilers and there is never a need to bypass fresh steam through the heating coils. By routing exhaust steam from the mud pumps, boiler feed pumps and generators, fluid content of the unit will be heated to the desired level. Actually, there are times when there is no need for feeding exhaust steam from all of these units to the preheater. Hence, the system is assembled with control valves in the exhaust system to block excess steam from the preheater chamber.

Automatic Controls. Both the fluid level and temperature are automatically controlled The fluid level control assembly is a lever assembly actuated by a float and piston type pump regulating valve. Turnbuckle adjustment permits placing the float at the desired level. A supplementing bypass system discharges excess water into the boiler pit when there is little demand for steam generation.

Since it is often damaging or inefficient to feed water to a pump when the temperature exceeds 180 degrees, a thermostatic control maintains the water temperature at the desired, workable temperature at all times. In operation, the thermostatic control will bypass steam from the coil or spreader entrance through the stack. Incorporating a commercial regulating device plus simple, shop made accessory equipment, the temperature control performs in the desired manner and requires minimum mainte-

nance attention. The fluid temperature is double checked by a guarded thermometer tapped into the side of the heating chamber. Figure 1 shows the fluid level and temperature control system exterior arrangement.

Simple Chemical Treating System. Figure 2 shows how the small, plate metal chemical tank is welded to the heater tank side. In the event a phosphate treating program is planned, it will be wise to weld a partition near the tank back to insulate against temperature transfer from the preheater shell to the chemical solution. Air space, provided in this manner, will eliminate heating and converting the complex phosphate solutions.

The connection entering the tank base feeds cold water into the chemical blending tank. Attaching a small, open-end valve permits flushing of residue from the system. The flanged opening atop the tank allows chemical addition but, with the metal lid in place, foreign matter cannot enter the storage reservoir and contaminate the treating solution.

Feeding chemical solution from the reservoir to the hot water pump suction can be accomplished by gravity drip or a small steam or gas operated pump. The latter method is preferable since it is possible to better regulate the rate of chemical feed.

Simple Construction. Unit structural features emphasize simplicity. The tank shell, formed with heavy gauge sheet metal, can even be spliced of plating salvaged from discarded equipment. Anchored to a heavy gauge base which extends beyond the outside tank diameter, three-inch diagonal pipe bracing anchors the shell to eliminate breathing or unit movement as exhaust steam feeds through the system. A drain is welded below the unit to permit removing fluid and residue prior to rig moves.

One side of the tank is rigged with a bolted inspection plate for easy internal servicing. This particular plate can be salvaged from crude storage tanks retired from service.

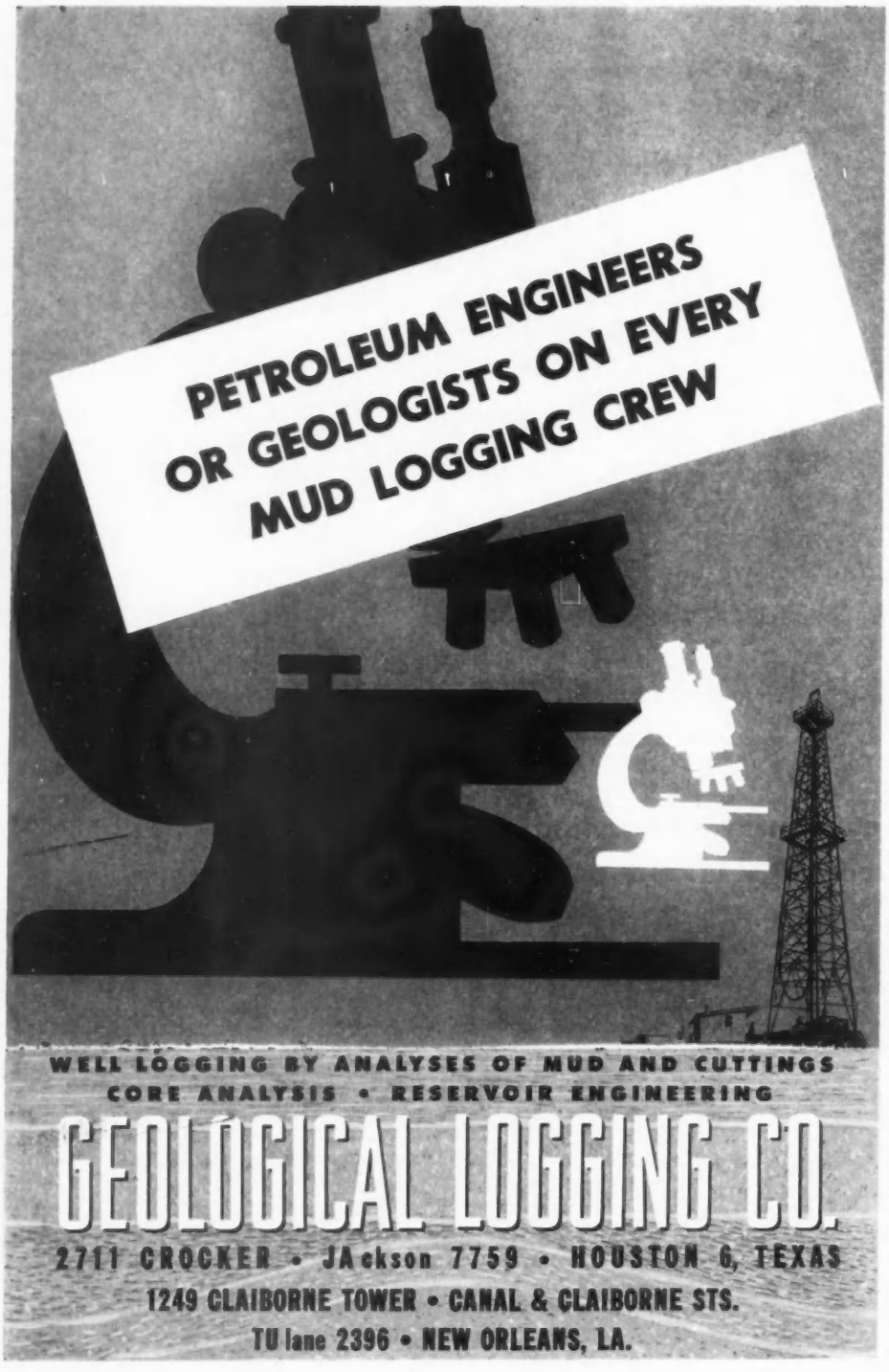
The upper deck, welded to the lip of the rolled sides, is center cut to accommodate a lighter gauge metal stack. All pipe entrance ways are welded in place to eliminate possible leaks.

Internal Design Flexible. The unit heating element can consist of either a pipe coil or a steam spreader-deflector. Plan selection is simply a matter of economics since either steam routing method will serve the purpose. Undoubtedly the steam spreader-deflector system offers merit due to minimized installation expense.

The coil installation consists merely of forming a heat exchanger from three-inch pipe. Steam enters the exchanger through a base connection where upper gathering device diverts it through the stack. This system should include some sort of back-pressure device within the coil.

The most simple and least expensive plan is the combination spreader-deflector system where steam is spread with a perforated base pipe and funneled into the stack with upper deflector. In operation, steam merely bubbles up through the fluid body and is gathered and deflected by a trap anchored immediately below the stack.

Aside from increased boiler efficiency and reduced fuel requirements made possible by the preheater system, anchoring the unit to the boiler feed unit reduces not only transportation needs but also rigup time. The system is designed with permanent connections between the preheater plus the hot and cold water pumps. Hence, rigup requirements involve only coupling the exhaust gathering line. This feature in itself will provide the operator a few extra hours during rigup and teardown operations.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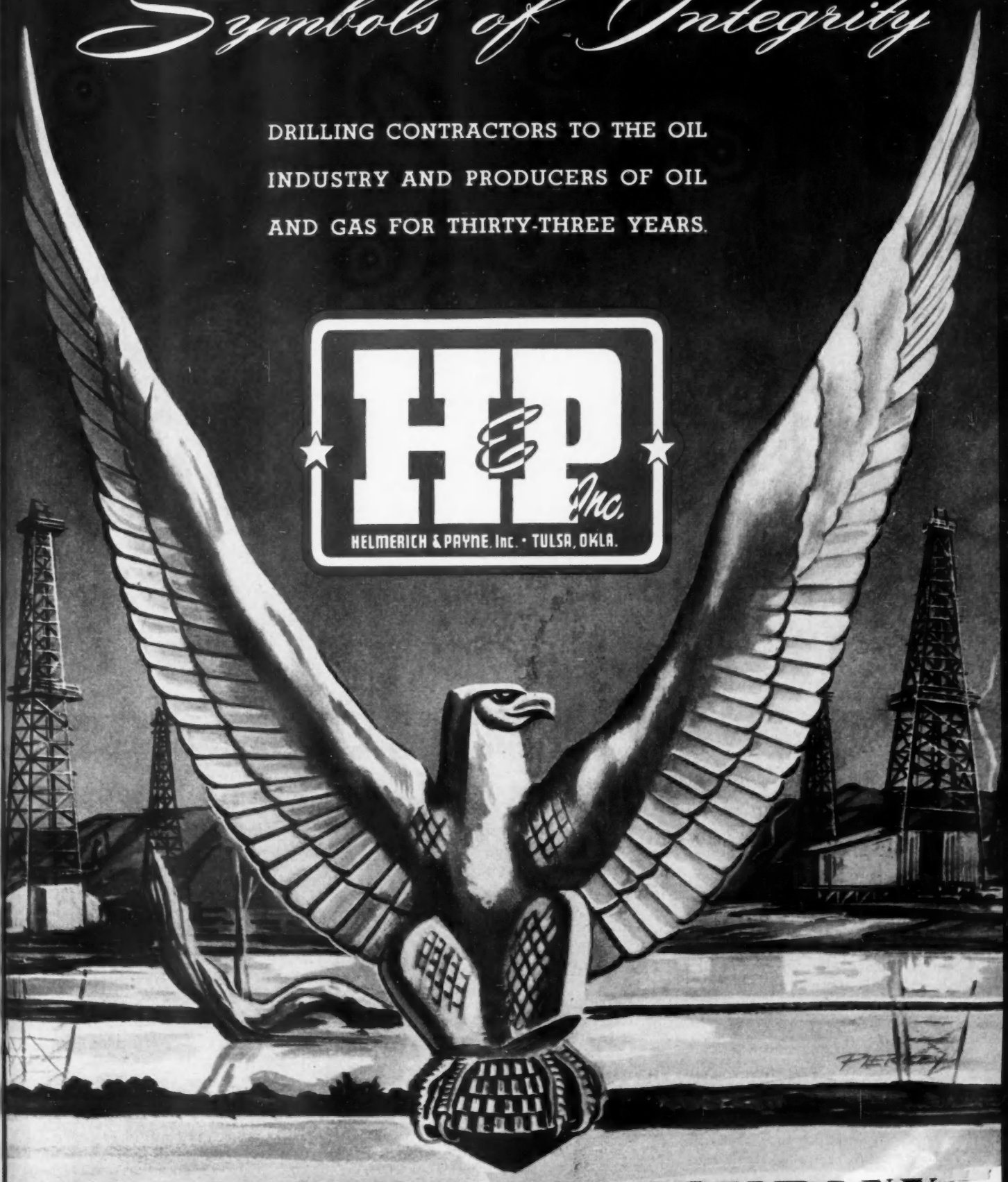

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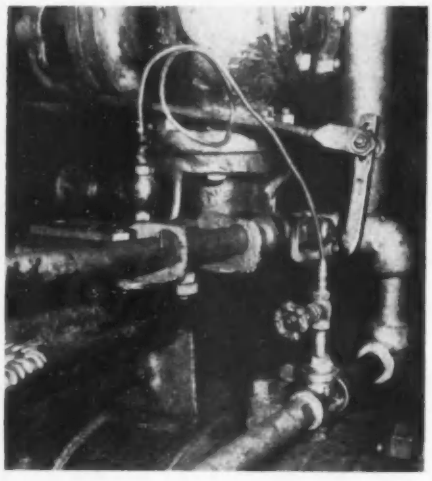


Bypass Improves Engine Response

Although it uses only a little more steam, the bypass system illustrated will liven a steam engine's throttle response when tripping a rig or making a connection.

The simple, inexpensive installation involves purchasing a limited assortment of small valves, fittings and copper tubing; however it erases the danger of an engine "hanging-up."

The lower, incoming steam line is parted and rigged with a tee, as is the steam line on the other side of the throttle. Gate valves are made up in both tees and copper tubing connects the incoming and engine feed line. In this manner, a limited amount of steam continually bypasses the master throttle valve, thus allowing the engine to idle at all times.

In practice, the engine never stops when the rig is being tripped. When the throttle is spun wide open, rather than having to kick off a dead engine the steam flow hits an engine already moving. The response is immediate and a few seconds can be saved since the engine is never subjected to a shock steam load at static movement.

Guided Fingers Can Stack Pipe

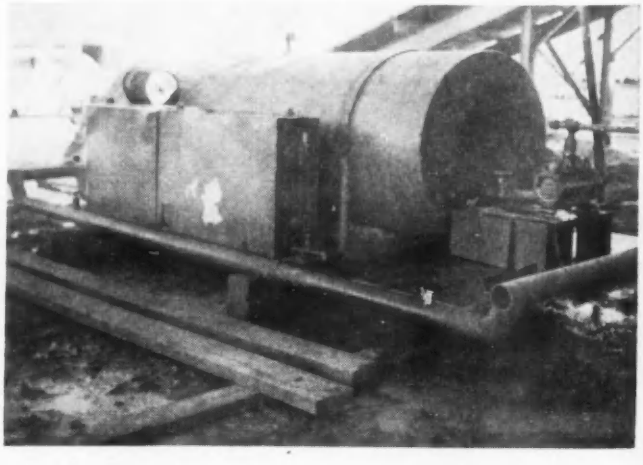
When four joints of drill pipe or tubing are racked in a stand, it is always a problem to keep the pipe from buckling and swarming in the middle. Often, the problem is so serious that it is necessary to use two derrick men.

By installing another set of fingers and attaching rope to each arm, one of the floormen can operate the racking device as pipe is stacked in the derrick.

The practice is simple to follow out and inexpensive to install. At the same time, pipe can be racked with speed and safety on deep wells using four joints of drill pipe to a stand.

Skid-Mounted Fuel Tanks Prove Convenient Arrangement in Field

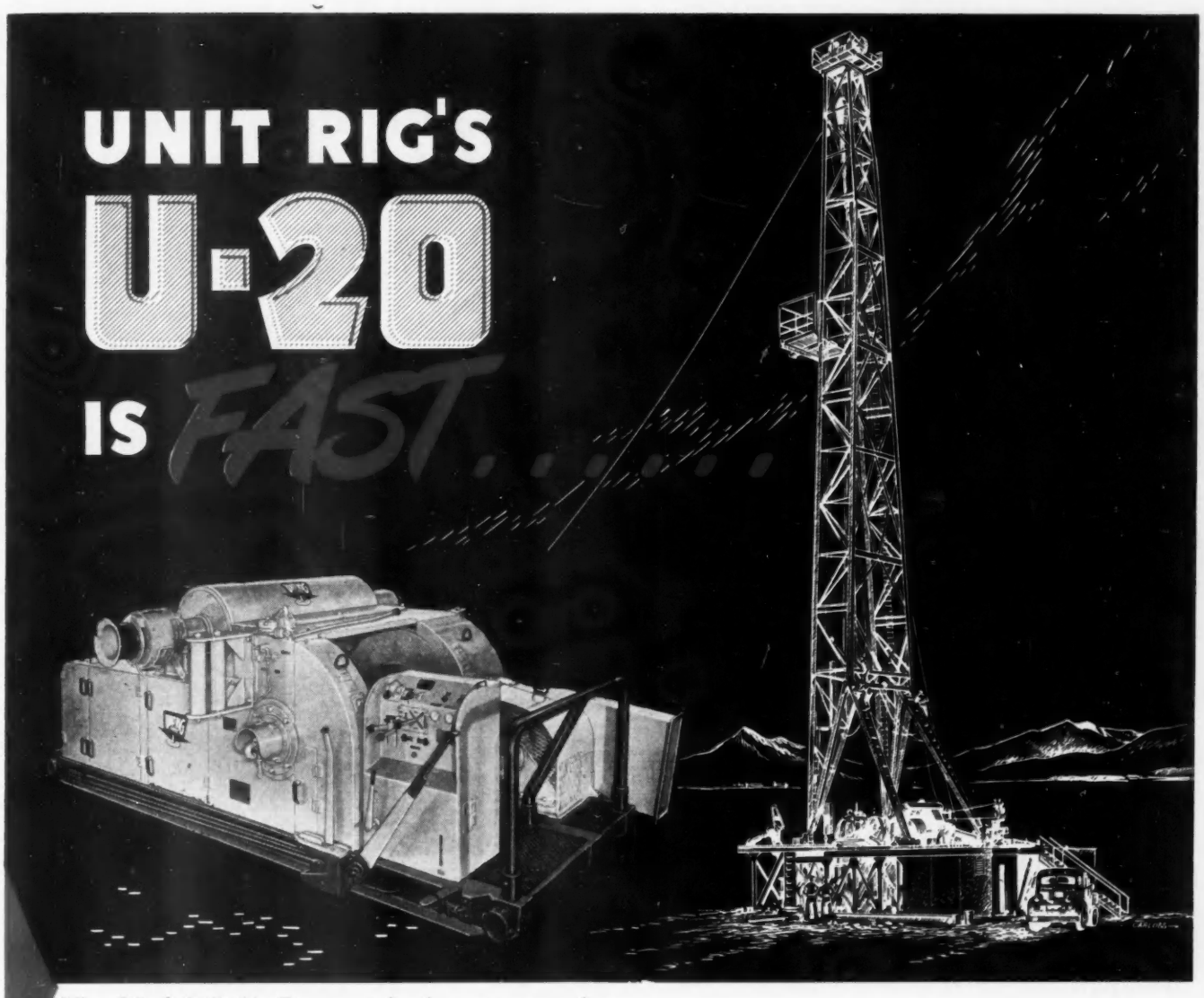
A simple arrangement for handling fuel and lubricants for diesel rigs is constructed by mounting the containers on skids. This allows for easy transportation between rigs and if it is impossible to get a distributor's truck out to the rig, the entire unit may be trucked to the bulk station. Of course on rig moves, the unit can easily be taken by the nearest bulk station and filled.



The diesel fuel is carried in a ten-barrel tank with a hand operated pump on one end, so that the fuel can easily be pumped up to the day tanks on the engines. This is done in a few moments by the engine man.

The lubricant containers are composed of three compartments in a rectangular box which rests beside the larger tank. Each of the compartments can be filled with a different lubricant.

UNIT RIG'S U-20 IS FAST.....



The Model U-20 Drawworks has proven that it is a fast, smooth economical rig even under difficult drilling conditions. Drill Faster - - - with the SIX speeds to the rotary table ranging from 57 to 626 R.P.M. at maximum engine speed. Hoist Faster - - - with the SIX drum speeds, divided into a high and low range. SPEED - - - for hoisting empty blocks and POWER - - - for raising off slips readily available thru single lever high-low clutch control. Maximum trip speed is attained by the free spooling drum, hydromatic brake pipe "fall" control and the large powerful drum brake.

Buy Speed - - - Buy The Best - - - Buy The U-20

UNIT RIG -&- EQUIPMENT CO. TULSA, OKLAHOMA U.S.A.

DESIGNED FOR THE JOB...

UR-521

UNIT RIG DRAWWORKS ARE SOLD EXCLUSIVELY THROUGH THESE AUTHORIZED DISTRIBUTORS IN THE U.S.A. AND CANADA

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EXPORT SALES — MIDCONTINENT SUPPLY COMPANY, 42 Broadway, New York City. Cable— MIDUNITRIG

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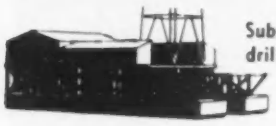
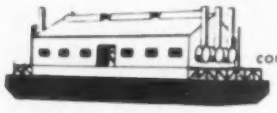
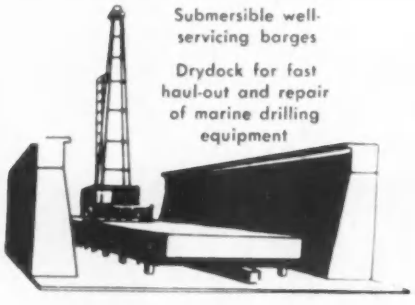

Submersible drilling barges

Tugs


Boiler and compressor barges

Water, oil, and supply barges


Submersible well-servicing barges

Drydock for fast haul-out and repair of marine drilling equipment

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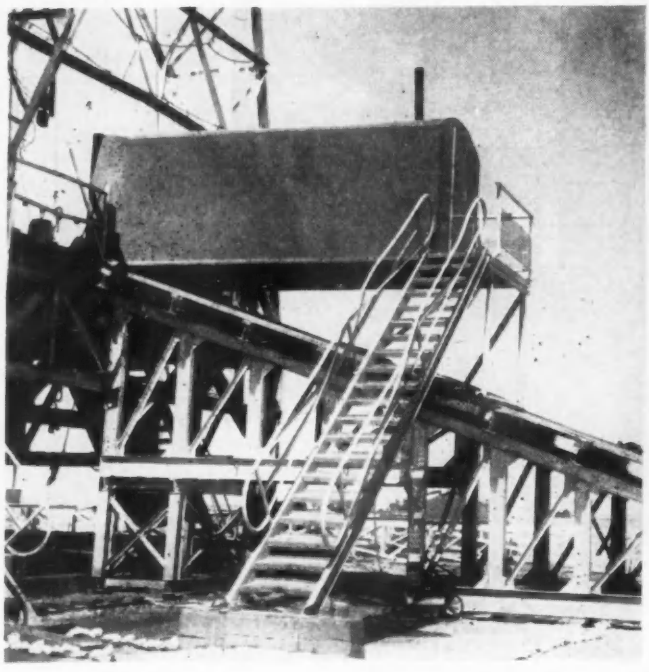
Tool House Can Be Placed on Derrick Ramp While Rigging Up



In many cases the derrick ramp is not needed after the rig has been set up and in operation. When this is the case, it is possible and practical to utilize this space for the derrick floor tool house.

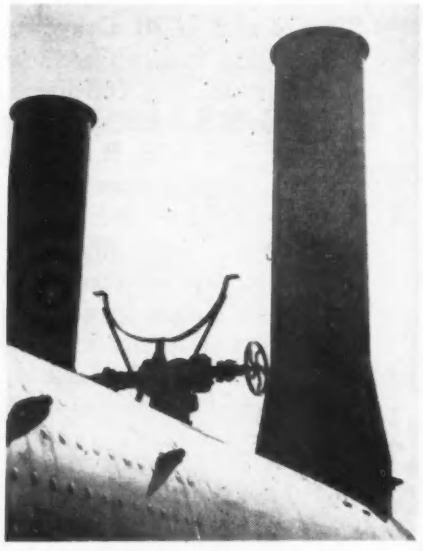
Mounted on heavy skids, the tool house normally does not require additional reinforcement. In the event proper reinforcing is anchored to the tool house base, the only remaining requirement for the ramp structure is welding a two-inch pipe frame. The width and height of the supporting frame will depend upon the width of the tool house and the distance from the ramp surface to the derrick floor level.

Two diagonal braces extend from the upper horizontal support to a point well up the ramp. These diagonal braces are secured to the base of the support frame by means of two tie rods made of the same size pipe.

The illustrated tool house is rigged with a back extension forming a small entrance ramp and anchorage for the stairway. This feature is optional, however, since on some rigs access to the floor is provided by a stairway direct from the ground to the derrick floor.

The support is simple and inexpensive to build and, at the same time, its use permits further utilization of the derrick ramp.

Support Reduces Damage to Stack



When it is practical to move boilers with the stacks attached and dropped down over the barrel, the illustrated supports will help avoid damage to the stacks by keeping them in place.

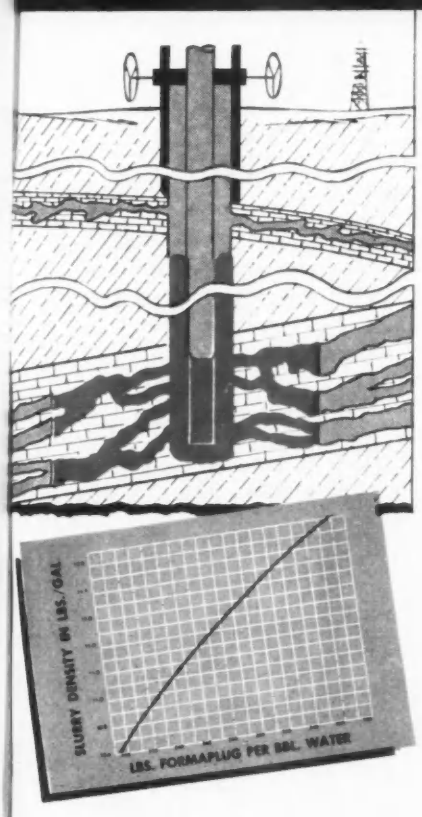
Made of pipe and strap iron, the support is simple to rig and can be left in place at all times.

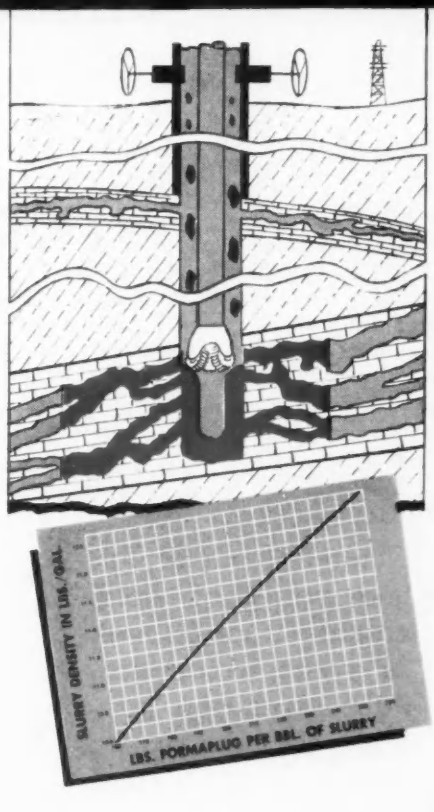
A two-inch nipple approximately one foot long serves as the main support post and is reinforced with strap iron welded to the boiler barrel. The support yoke is formed of heated strap iron with rounded ends to eliminate the possibility of rupturing the stack skin should one of them drop on the support. Angle iron reinforcing is welded to the yoke and pipe stand to secure the support.

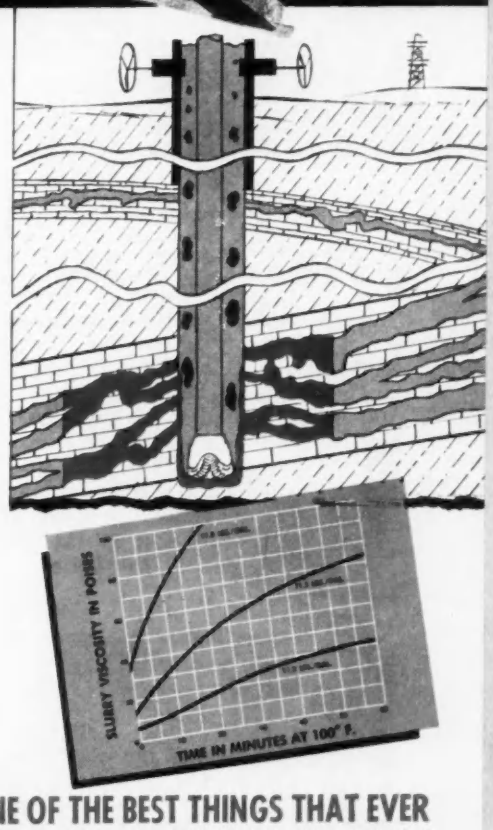
For boiler moves, the stacks rest in the yoke and remain in place because of their weight.

ANNOUNCING FORMAPLUG

another outstanding LOST CIRCULATION CORRECTIVE from MAGCOBAR







FormAplug seals cracks, fissures, solution channels, and other relatively large cavernous types of formation openings. It permanently plugs openings — doesn't merely plaster them over with a temporary mat. FormAplug stabilizes weak formations which might rupture with the hydrostatic pressure of heavy mud.

FormAplug is a time setting clay cement which is squeezed into formation fractures with ordinary cementing equipment. After a short time the slurry thickens to a rubbery solid, having a gel strength equivalent to 40,000 Stormer grams, which is capable of withstanding considerable pressure differential without movement.

The above diagrams show FormAplug being squeezed into a formation channel. Following placement of the slurry, the drill pipe is removed. After waiting a period for the FormAplug to develop strength, the FormAplug remaining in the hole is drilled out.

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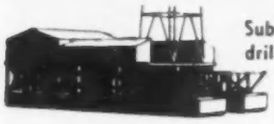
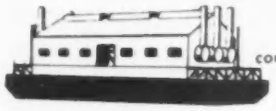


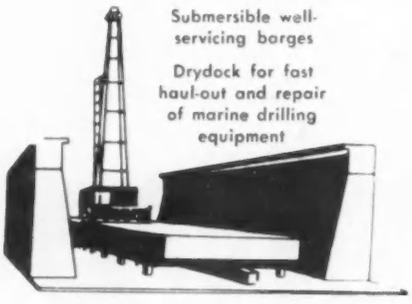
Submersible drilling barges

Tugs



Boiler and compressor barges

Water, oil, and supply barges



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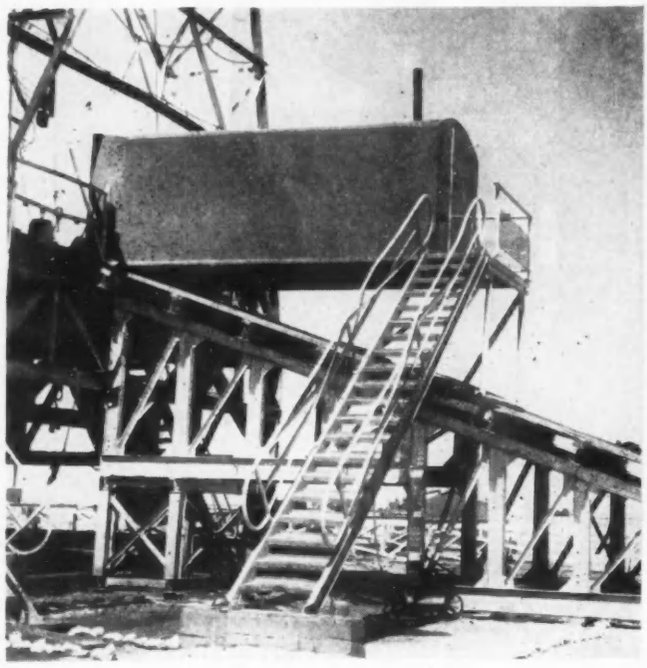

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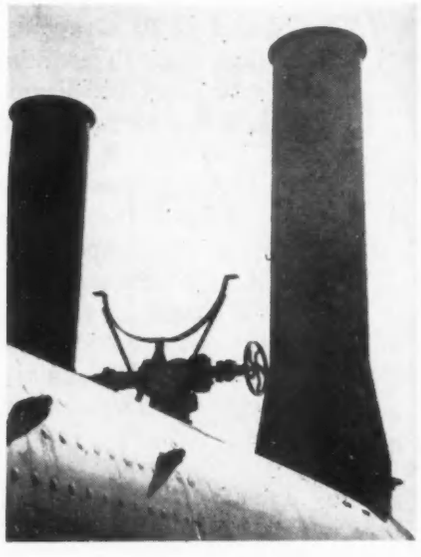

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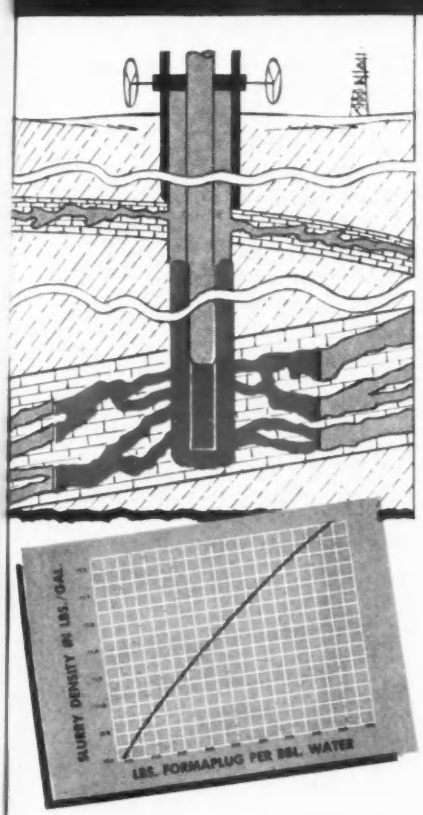

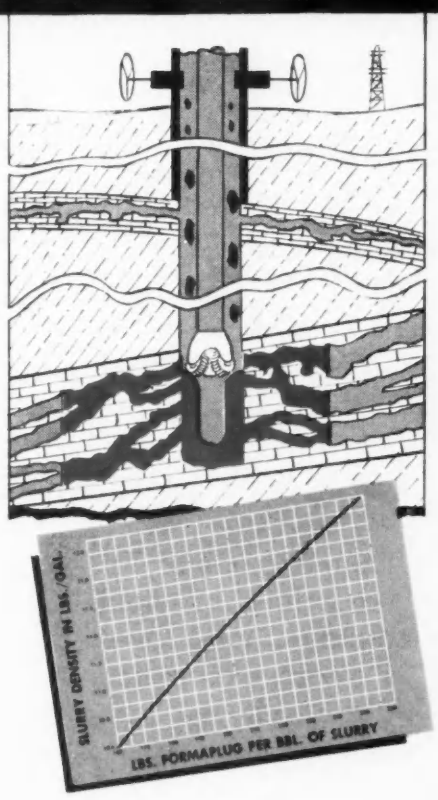

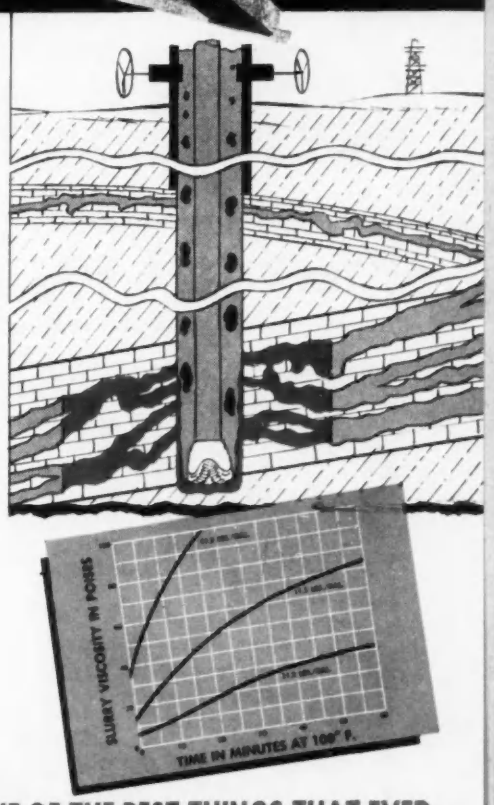

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Pipe Frame Carries Flooring Load

The convenience of derrick floor tool houses is an accepted fact; however, rigging a simple, easily moved support often presents a problem. Possibly one of the simplest supports ever devised is shown in the photograph, where a pipe frame carries the full load. The streamlined design permits ease in location - to - location transport while the rugged structural features allow rough handling in moving.

Both vertical and horizontal members of the frame are made of 4½-inch drill pipe while the diagonal braces are of two-inch pipe. In building the unit, the first requirement is to cut two base pieces approximately five feet long. Then, the two vertical supports are cut a length which will lift the tool house to floor level. Both the base and top of these two legs are shaped with a torch so as to conform with the pipe. At this point the upper horizontal support is cut, its length depending upon the width of the tool house, and the entire framework is welded together. It will be noted that a short piece of half-inch rod is welded atop the upper support to retain the tool house skid in proper position.

Once the drill pipe frame is completed, the two-inch diagonal braces are cut and welded to the structure. Two braces extend from the bottom of the upper support while the remaining two braces are welded to the base piece and leg.

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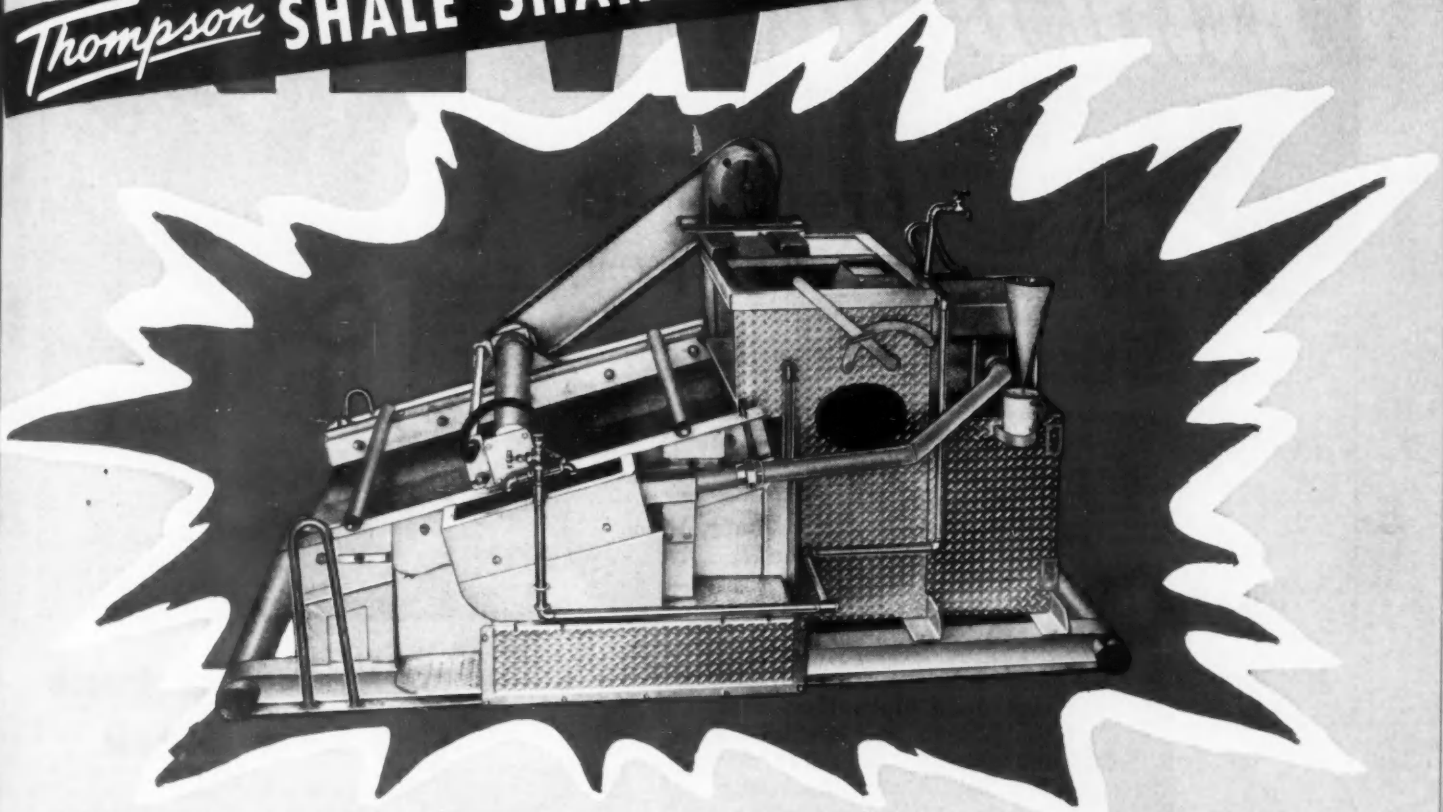
NEW

Thompson SHALE SHAKER & SAMPLE MACHINE



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Thompson, leading manufacturer for many years of the Famous Self-motivated Rotating Shale Separator, now introduce a new Vibrating-type SHALE *SHAKER*. This Thompson SHALE SHAKER has been proven in the field and many of them are operating throughout Oklahoma and Texas with complete satisfaction. Many NEW and IMPROVED FEATURES — some exclusively Thompson — spearpoint this highly efficient machine. Check these advantages:

Here the operator is taking a sample from Sample Machine exclusive on NEW Thompson Shale Shaker.

Above is rear view of NEW Thompson Shale Shaker showing convenient wash basin and tool cabinet.

EXCLUSIVE FEATURES...

- **SAMPLE MACHINE for easy sample taking**
- **LIFTING BALLS for easy pick-up**
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- **STATIONARY WATER SPRAY for washing screen**
- **SAMPLE, SAMPLE BAG, AND TOOL CABINET**

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- Extra Strong Screen Bed
- Coated Against Corrosion and Rust
- All heavy Steel — welded construction
- Takes Heaviest Mud Flow
- Uses Electric, Steam, Gas Engine or Oil Drive
- HIGHLY ECONOMICAL OPERATION

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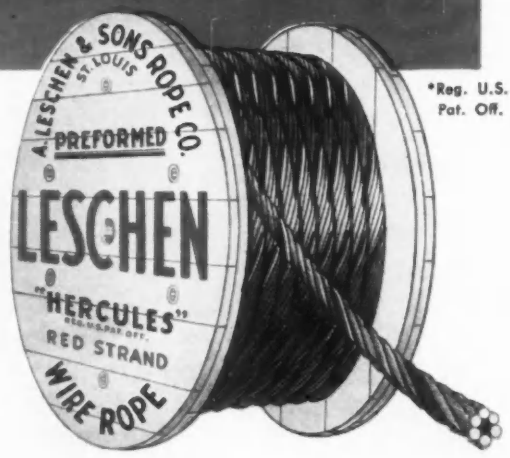
Write for free copy of your "Use and Care of Leschen Wire Rope."



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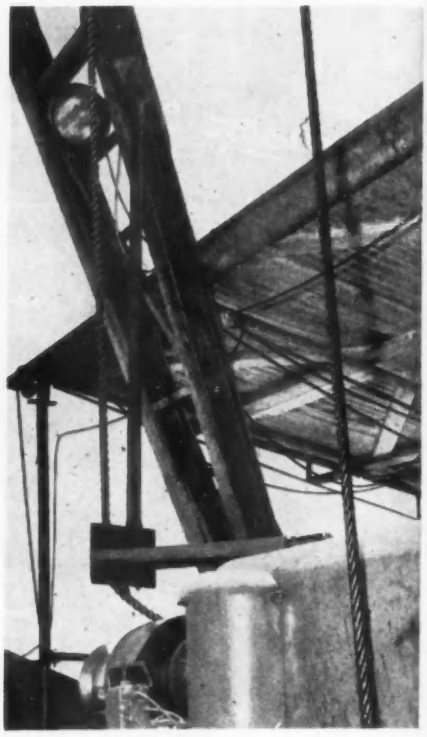

Support Fastens Cat Line Block

When a drilling mast is used, it is often a problem to anchor the catline clamp and block system. In some instances, the drawworks case is high enough to provide handy anchorage space; however, if this is not possible, the illustrated method will serve well.

A section of one-inch angle iron is bent into a triangle with a one-quarter inch plate welded to the drawworks side of the frame. This plate is then drilled to house anchor bolts which extend through the drawworks case. The remaining end of the frame is rigged with another section of plate steel for supporting the pulley and locking device. A vertical support, made of one-inch angle iron, is bolted to the clamp plate and extends to a point on the mast leg where it is connected to a face plate. The latter plate is welded to the mast leg to provide a smooth surface above the channeled leg.

The support is inexpensive to construct, provides rigid anchorage for the catline and is easy to disassemble for rig moves.

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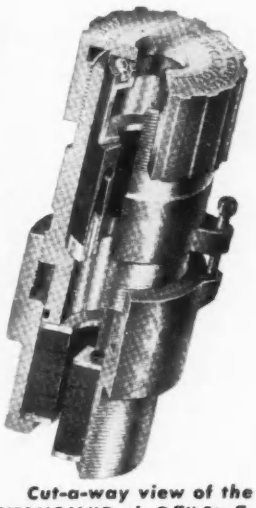
● Here's a Simple and Inexpensive Method of "PACKING-OFF" a Well

With the VERNON "Pack-off" Stuffing Box you can quickly and easily pack off a well without the use of special equipment. This is desirable when the well is to be temporarily sealed off or if repacking the stuffing box is necessary, since the usual oil leakage is eliminated.

HERE'S HOW IT OPERATES:

To seal off the well involves merely loosening the Safety Lock Screw an screwing the Stuffing Box Body dow into the "Pack-Off" Adapter. Th.. compresses the lower set of split moulded packing rings, causing them to expand around the rod and pack off the well. When operation is to be resumed, the Stuffing Box Body is backed off enough to completely relieve the lower packing rings, and the Safety Lock Screw is inserted.



Cut-a-way view of the VERNON "Pack-Off" Stuffing Box. The stuffing box portion of this "Pack-Off" Box is similar in construction to the standard Vernon Stuffing Box.

VERNON
"Pack-Off" STUFFING BOX

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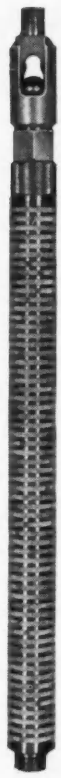

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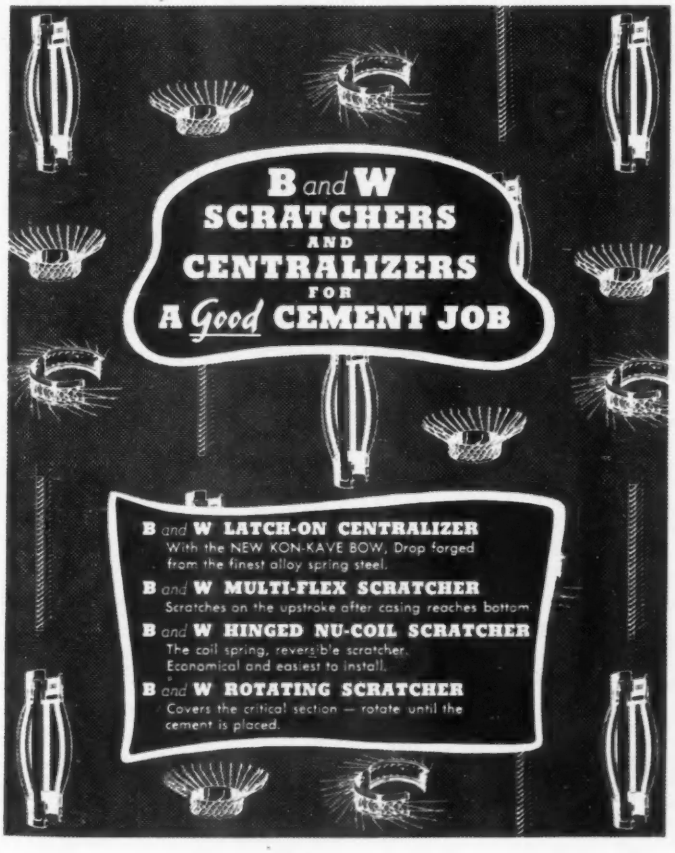
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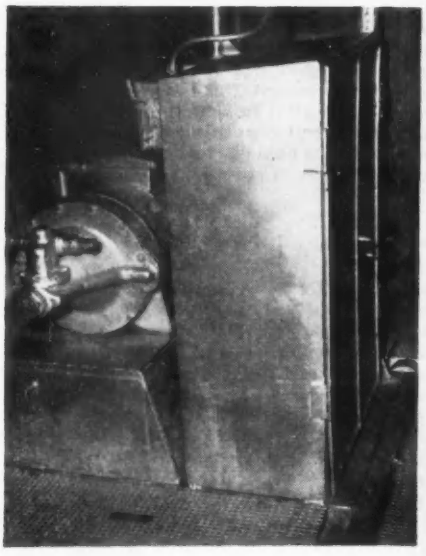
Generator Panel Protects Controls

Electrical controls, when left out in the open, are subject to serious damage from blows, steam and weather. An enclosed panel attached to the base of the generators, guards all delicate electrical controls from damage.

Construction of the case involves welding an angle iron frame the proposed size of the cabinet. Then, light gauge sheet metal is tack welded to the frame structure.

The front of the cabinet is covered with hinged doors which latch in place with a revolving metal rod locking device. In the event the control system does not require all the room in the cabinet, shelves can be put in for parts and tool storage.

Besides the control case, another storage cabinet has been built beneath the two generators. Since it is of advantage to mount the generators on some sort of a base, this operator decided to construct the base of angle iron frame covered with sheet metal to provide added storage space for hand tools.



The box is made of metal segments salvaged from discarded equipment, and construction cost primarily involves labor alone.

Boxed Batteries Are Protected

Independent pump units must be rigged with batteries to start the drive engine. Sometimes it is possible to have the batteries near the engine; however, when this is not possible, a case can be mounted on the pump skid frame to afford adequate protection for the batteries.

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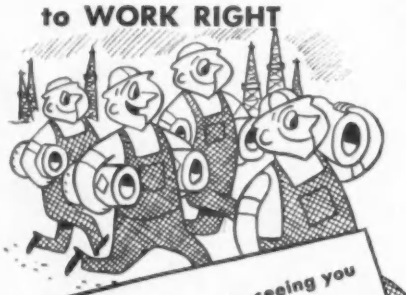

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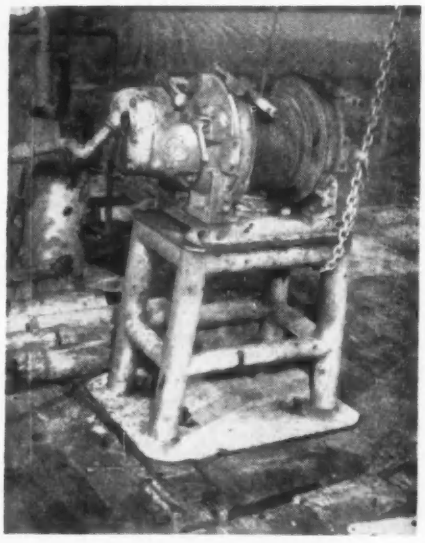
gauge sheet steel and is welded to the pump skid. A slot has been cut on one end to permit running the battery cables from the case to the engine. Because of the battery weight, it is not necessary to anchor the units within the case.

Although the batteries can be placed in any sort of makeshift case, the illustrated unit, which is inexpensive, will protect the batteries and will simplify transportation of the pump since the case and batteries are left in place.



Pipe Structure Anchors Hoist

Air hoists, which are often used to operate the derrick line, are more convenient to actuate if mounted on some sort of a base. With this provision, the crewmen operating the unit will be in a better position to observe over-all operation.

The first step in building the base is to cut a quarter-inch steel plate a size slightly larger than the over-all dimension of the hoist. Then, four two-inch pipe legs are welded to the base plate. After the four legs have been anchored, diagonal braces and a top support are welded in position. Another steel plate welded atop the frame supports the hoist.

Usually, the hoist is rigged with a small skid which can be drilled to house bolts anchoring the unit to the platform base. The final step consists of drilling four one-half inch holes in the lower base to permit securing the entire unit to the derrick floor.

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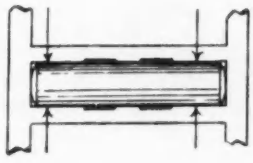

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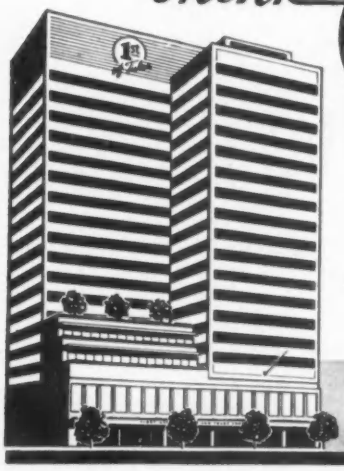

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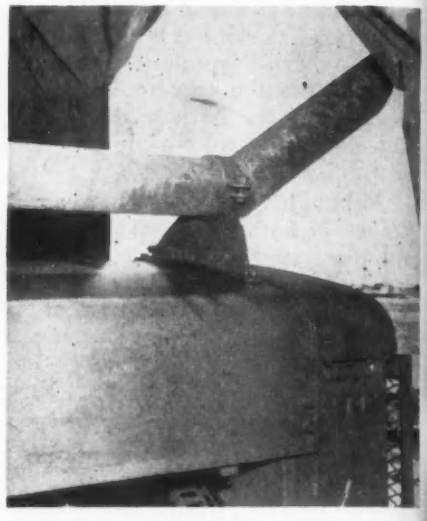

Brace Supports Exhaust Pipe

A problem often encountered by the drilling contractor is the proper placement of exhaust pipes on derrick floor engines. The illustrated unit drives an independent rotary table and, with the exhaust stack facing away from the floor, removes all gases from the work area.

The manner in which the exhaust pipe is extended over the engine hood is simple; however, without the clamp anchoring device, the stack would vibrate and ultimately come loose. To eliminate this problem, a section of quarter-inch steel plate was cut, rigged with a perforated shoe plate and a clamp adapter. Another section of quarter-inch strap iron was formed to serve as the top section of the clamping device. Then, by placing bolts in the perforated strap and formed base, it is possible to securely anchor the exhaust stack in place.

When it is necessary to repair the engine, it is a simple matter to loosen the stack clamp and swing the unit aside to provide adequate work space above the engine.

Revolving Spool Removes Kinks

It is a simple matter to spool rope; however, it is often difficult to remove kinks which may develop in the line. To remove this problem, one operator rigged the illustrated spool which will rotate through a complete circle to smooth out kinks.

The spool is formed of three-eighth

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inch metal rod with a one-inch spindle. The spool yoke, which is made of one-half inch strap iron, is made to friction lock the spool in place. Nut retainers are attached to each end of the spindle to eliminate the possibility of its slipping out of the yoke.

The back of the strap iron yoke is rigged with a cranking device made of one-inch pipe and strap iron. Retained by a two-inch pipe nipple, the cranking device is anchored to the rig guard rail system by means of a one-foot section of two-inch pipe. The pipe support has been notched to permit slipping it over the guard rail immediately above one of the posts.

In operation, the cat line is spooled onto the unit and, to eliminate kinks,

the complete spool is rotated periodically.

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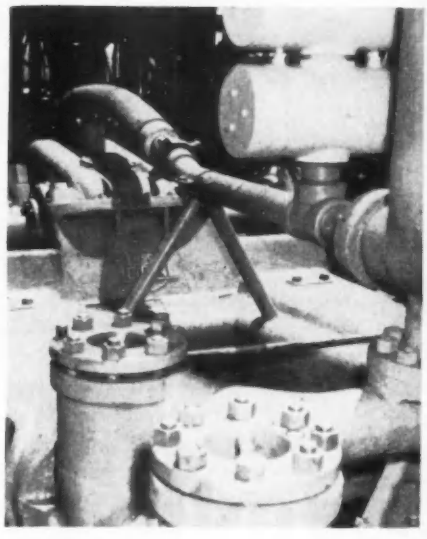

Support Reduces Line Vibration

When the mud pump discharge line is rigged with a rubber hose attached to stiff connections, it is advisable to reinforce the pipe connections with a support to eliminate damage from vibration. If this practice is not observed, it is likely that difficulty will be experienced with the stiff connections breaking out because of line movement.

The illustrated support is made with two sections of 1½-inch pipe angle-welded to the pump case. Then, strap iron is welded atop the two supports to form a bolt type clamp.

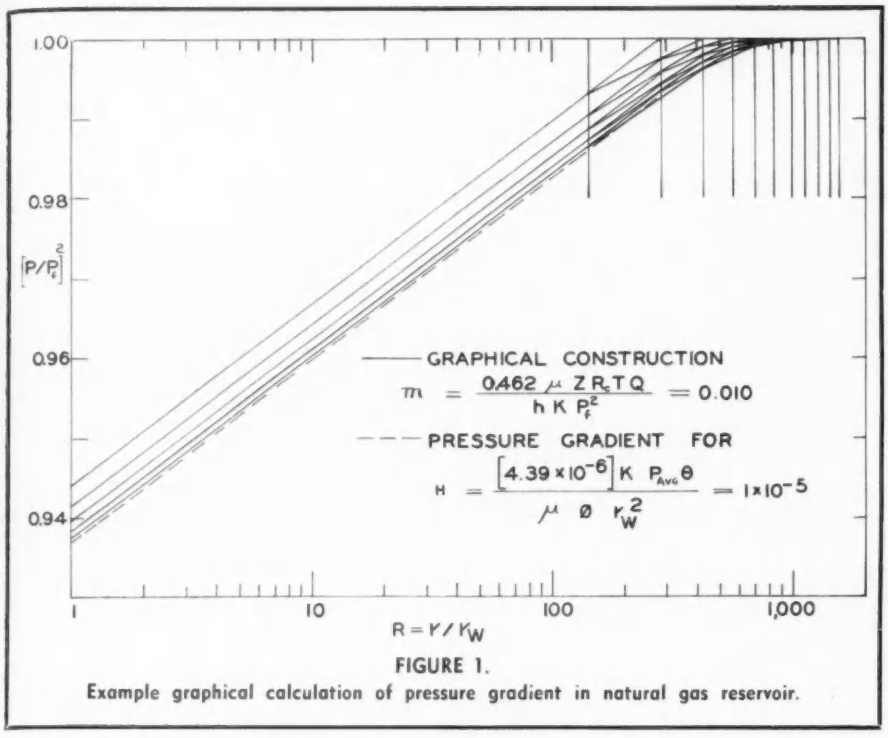

FIGURE 1.
Example graphical calculation of pressure gradient in natural gas reservoir.

How to Determine Gas Well Interference Graphically

What happens in a natural gas reservoir can be calculated by this simple solution to an otherwise complicated mathematical problem.

By DR. DAVID CORNELL

Texas Petroleum Research Committee
The University of Texas, Austin

GRAPHICAL SOLUTIONS of the unsteady state flow formula for radial, laminar flow have been used to formulate a reservoir pressure gradient chart for the constant production rate case. A knowledge of the properties of the reservoir formation, the reservoir gas, and the production history of the well enables one to determine by use of this chart the extent to which a reservoir has been disturbed. By this means interference between gas wells may be estimated and the computation of reserves and deliverabilities of natural gas wells is facilitated.

Three major problems of natural gas reservoir engineering include the computation of gas delivery rates and pressures, planning well spacing for optimum recovery, and the estimation of gas reserves. These problems are closely related, since all are dependent upon the physical characteristics of the formation and of the reservoir gas, and are governed by the fundamental partial differential equation which describes all types of laminar flow problems in porous media. Difference between the problems arises in the various boundary conditions that must be applied to the fundamental partial differential equation to obtain solutions for each particular problem.

Considered here are the important set of boundary conditions which includes the specification of a constant pressure in an infinite reservoir at the beginning of the production period as the result of shutting the well in, and a constant rate of production of gas from the reservoir. This situation frequently exists when a gas well is shut in for a period of time, for reserves estimation, or because of production demands and is then produced at a substantially constant rate. The results may be used in predicting when interference between gas wells will occur and form the basis for computation of gas deliverability and more accurate reserves estimation.

Theoretical Basis

The general partial differential equation describing the radial, laminar flow of gas through a porous bed is:

$$\frac{\partial (p^2)}{\partial \theta} = \frac{(4.39 \times 10^{-6})\ (K)\ (Pavg)}{(\mu)\ (\Theta)\ r_w^2} \left[\frac{\partial (p^2)}{\partial r^2} + \frac{1}{r}\ \frac{\partial (p^2)}{\partial r}\right] \qquad (1)$$

In this case a graphical method has been used to solve equation 1. Details of the graphical solution have been presented by Cornell and Katz.[1] Briefly, the graphical solution consists of averaging the pressures at two points in the reservoir at a given time. The result is the pressure at an intermediate point but at a later time. Thus, the pressure gradient at one time can be used to establish the pressure gradient at a later period of time. The calculations presented here are limited to the case of a regular, homogeneous, horizontal, producing formation without water drive and with gravity effects neglected.

Figure 1 illustrates this method of calculation. The boundary condition of a constant rate of gas production has been met by specifying a constant slope of the pressure gradient near the well bore for a plot of $(p/p_f)^2$ versus (r/r_w) on semilog paper. The steady state equation given by equation 2:

$$\left[\frac{p}{pf}\right]^2 = m\,[\log_e (r/r_w)] + \left[\frac{Ps}{Pf}\right]^2 \qquad (2)$$

indicates that steady flow is a straight line on such a plot. Specifying a constant value of the slope m of the line representing equation 2 denotes a constant production rate since m is proportional to Q as in equation 3.

$$m = \frac{(0.462)\ (\mu)\ (z)\ (R)\ (T)\ (Q)}{(h)\ (K)\ (p_f^2)} \qquad (3)$$

The example graphical calculation on Figure 1 was based on a value of m of 0.010.

The graphical solution is carried out until the desired period of time

has been covered. A dimensionless factor, H, represents this period of time. The actual time in minutes, Θ, may be computed from H by use of equation 4.

$$H = \frac{(4.39 \times 10^{-6})\ (K)\ (Pavg)\ (\Theta)}{(\mu)\ (\phi)\ (r_w^2)} \qquad (4)$$

A value of $H = (1 \times 10^5)$ has been used in the example graphical calculation. Figure 2 presents the pressure gradient calculated in Figure 1 in a more customary form. The pressure is given for each point in the reservoir using cartesian coordinates. The values of the formation pressure, p_f, and the radius of the well bore, r_w, have been arbitrarily chosen as 1000 psia and 0.5 feet for the purpose of preparing Figure 2.

Calculations of the type shown in Figure 1 have been repeated for a wide range of values of H keeping m constant at a value of 0.010. These results are summarized as Figure 3. If the reservoir pressure gradient is desired at any time, the value of H is computed from equation 4. The pressure gradient will be applicable only if m for the production period is 0.010. If m calculated from Equation 3 has some other value, the pressure gradient given in Figure 3 is corrected by means of equation 5.

$$\left(\frac{p}{Pf}\right)^2_{corrected} = 1.00 - \left[1.00 - \left(\frac{p}{Pf}\right)^2_{Fig.\ 3}\right](100)\ (m) \qquad (5)$$

Example

A natural gas well which has been shut in for a relatively long period of time is produced under the conditions given in Table 1.

For these conditions m = 0.005 and $H = (1 \times 10^5)$. The pressure gradient for m = 0.010 is read from Figure 3 and is corrected to m = 0.005 by means of equation 5. Table 2 gives these values of the pressure gradient for the condition of Table 1.

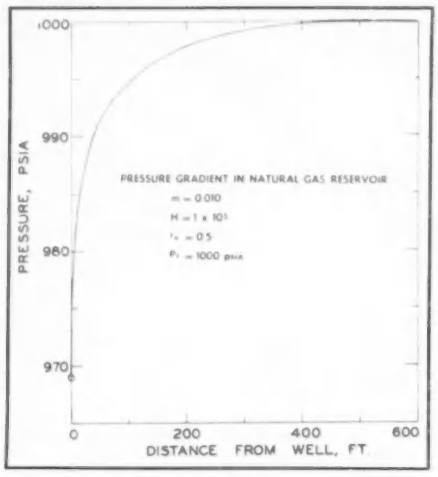

FIGURE 2.

Prediction of Well Interference

When two or more adjacent wells are being produced, the question arises as to the length of time before the wells will begin to interfere with one another. Such interference is complex and even after interference begins considerable time will elapse before the effects can actually be observed and interpreted at the well bore. Figure 3 can be used to predict when such interference will begin. For example, if two wells, having $r_w = 0.5$ feet, are one mile apart and are produced at a value of m of 0.010, interference will begin at the value of H of about 1,800,000 read from Figure 3. If the reservoir has the properties shown in Table 1, such interference would begin after 10,350 minutes or 7.2 days had passed. The interference would be very small at this time and a considerably greater period of production would be required for the interference to become measurable.

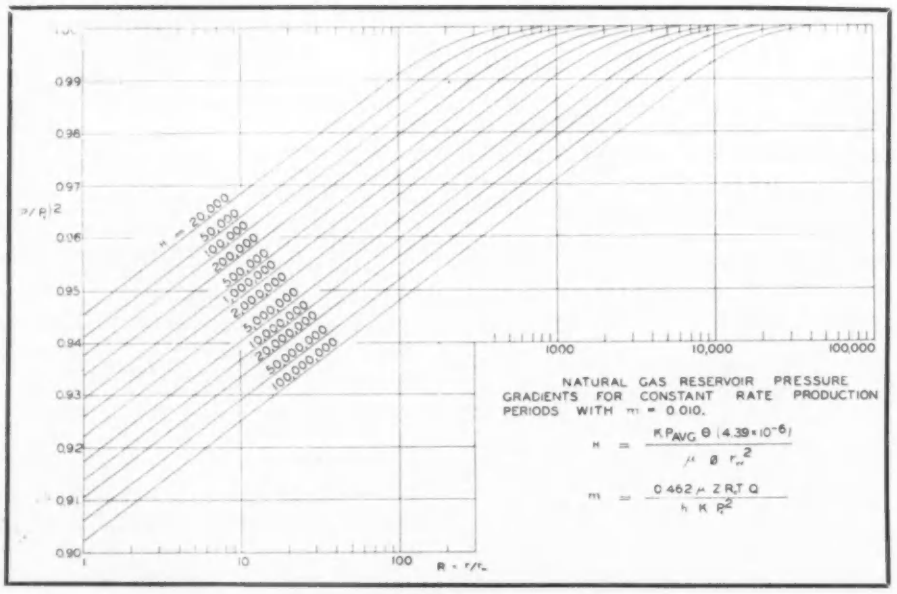

FIGURE 3.

ACKNOWLEDGMENT

This work was supported by The Texas Petroleum Research Committee at The University of Texas, Austin.

NOMENCLATURE

- h — thickness of the producing formation, feet
- K — permeability, millidarcies
- m — $\frac{(0.462)\ (\mu)\ (z)\ (R)\ (T)\ (Q)}{(h)\ (K)\ (p_f^2)}$
- p — pressure, psia
- Pavg — $(P_f + P_s)/2$
- Pf — shut in formation pressure, psia
- Ps — bottom hole pressure, psia
- Q — rate of gas production, MCF/D at 14.7 psia and 60° F.
- r — radius, feet
- r_w — radius of the well bore, feet
- R — r/r_w
- R_e — gas constant, 1545
- T — absolute temperature, °Rankine
- z — compressibility factor
- Θ — time, minutes
- H — $\frac{(4.39 \times 10^{-6})\ (K)\ (Pavg)\ (\Theta)}{(\mu)\ (\phi)\ (r_w^2)}$
- μ — viscosity, centipoise
- φ — fractional porosity

REFERENCE

[1] Cornell, D., and Katz, D. L., "Pressure Gradients in Natural Gas Reservoirs." Paper presented before the AIME, Oct. 2, 1952.

TABLE 1

Computed Pressure Gradients

Radius, Feet	Pressure for m = 0.010, (Figure 3) psia.	Pressure for m = 0.005, psia.
0.5	968	984
1	972	986
10	983	992
100	995	998
500	999.8	999.9

TABLE 2

Example Pressure Gradient Condition

μ	0.015 centipoise
z	0.94
T	560° R.
Q	532 MCF/D
h	20 feet
K	30 millidarcies
Pf	1000 psia.
Pavg	989 psia.
φ	0.20
r_w	0.5
θ	576 minutes

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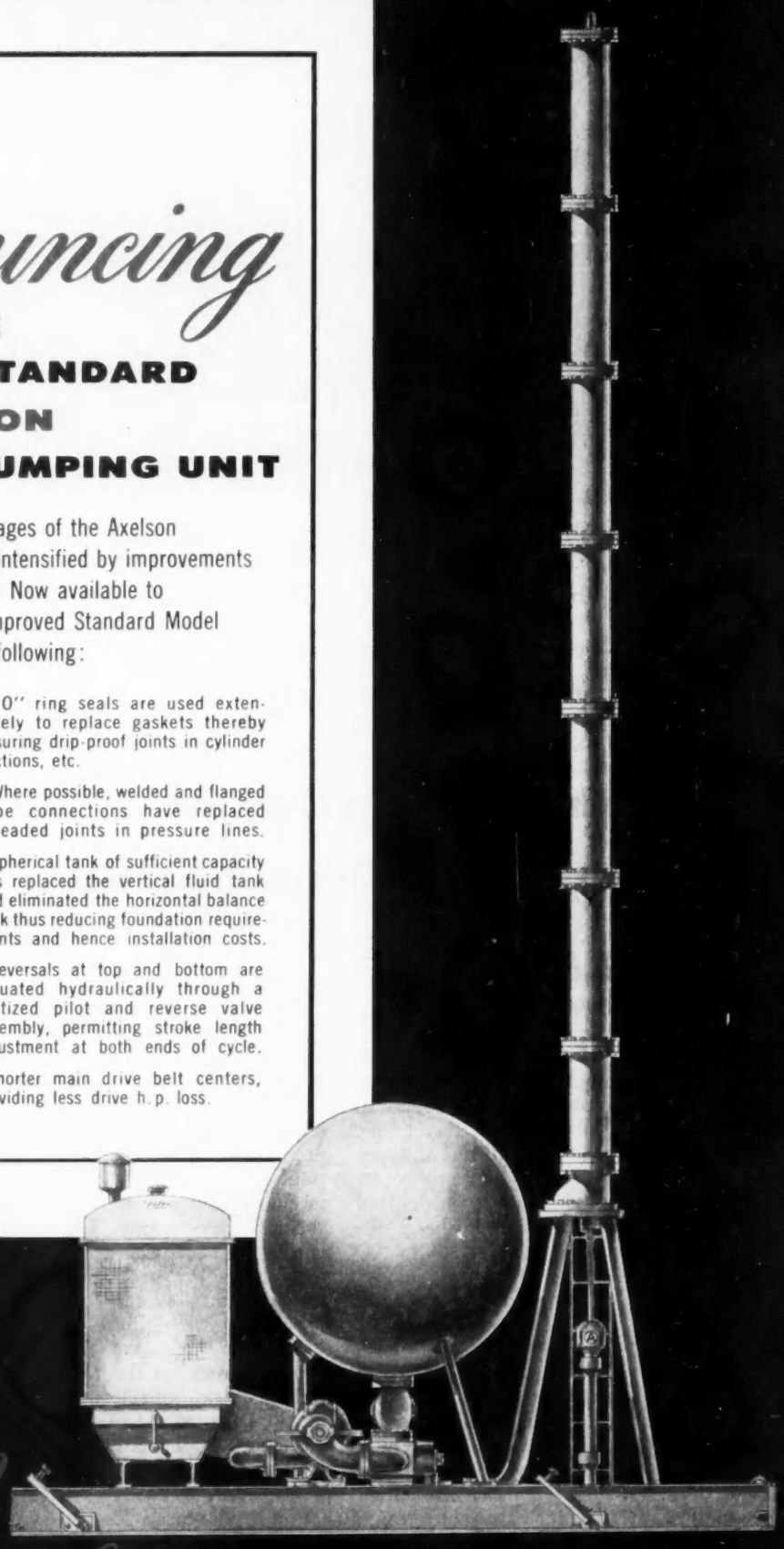

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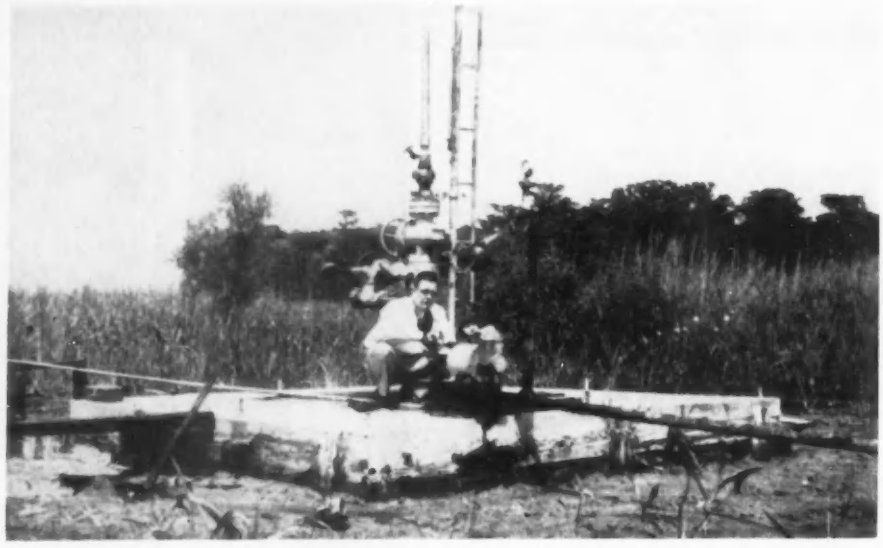


Wellhead installation for annulus injection system shown in Figure 3. Gas is taken from flow line riser at right of pump to drive the injection pump.

You can save money and also maintain effective control by considering the . . .

Mechanical Aspects of Corrosion Inhibitor Injection

By D. J. ELLIOTT
Texsteam Corporation, Houston

COSTS OF AN effective control program can be cut substantially by installing an inhibitor injecting system that fits the job. Various means are available to introduce different types of chemicals into the flow stream to minimize corrosion of production equipment. Magnitude of the problem, type of corrosion and chemicals used are among determining factors that govern the design of an adequate injection system.

Developments made in inhibitor injection over the years offer the operator a wide choice of methods that will not only provide maximum protection against corrosion, but which will keep treating costs down. These methods range from the old "stick method" to the latest fully automatic systems that require only supervisory attention and an occasional addition of chemicals.

Herein lies the mechanical aspects of effective corrosion mitigation, outside the realm of what is the best chemical to use. Advancements in chemical inhibitors offer a selection of effective products that have been proven in field and laboratory.

In the past few years the problem of combating corrosion has made great strides. Most producing companies have set up corrosion departments, and have staffed them with specialized personnel who devote all their efforts to the problems of corrosion. Greatest progress in combating the problem was caused by necessity, brought on by high replacement costs, scarcity of pipe, rods, and all steel products used in the production and transportation of oil and products related to the oil industry. The increasing costs of workovers in replacing corroded sections in wells afflicted by water encroachment due to oil depletion, increased the need for an adequate corrosion prevention program.

Early Efforts

Early efforts at corrosion prevention consisted of installing corrosion resistant materials, such as stainless steels, monel, nickel plating, chrome plating and lining the flow lines and tubing strings. These efforts, though partially adequate, had several limitations. The extreme high cost made this approach to the problem somewhat unsatisfactory.

It has been known for years that certain chemicals injected or added to the flow stream would decrease the rate of corrosion. As the problem became more acute, chemical companies realized the importance of developing specialized inhibitors to counteract the corrosive action of fluids produced.

As the program of combating this costly condition progressed, many mechanical problems became apparent. First and most common method of treating wells was by the "stick method." This means of injecting an inhibitor was simple since the chemical was made up into a solid cylinder that would pass through the tubing. A common lubricator or "boll weevil" was set up on the well head and the stick placed in the lubricator. Hand operation of the lubricator valves released the stick and it fell to bottom while the well was closed in. Considerable difficulty was experienced with this method as solubility of the stick was erratic and sometimes the stick came up the tubing when the well was opened and plugged the choke or

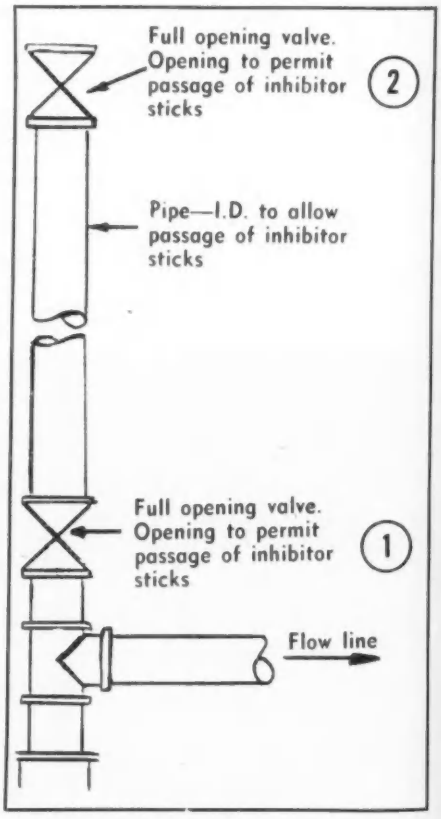

Full opening valve. Opening to permit passage of inhibitor sticks
2
Pipe—I.D. to allow passage of inhibitor sticks
Full opening valve. Opening to permit passage of inhibitor sticks
1
Flow line

FIGURE 1.
Schematic sketch of simple "boll weevil" inhibitor lubricator.

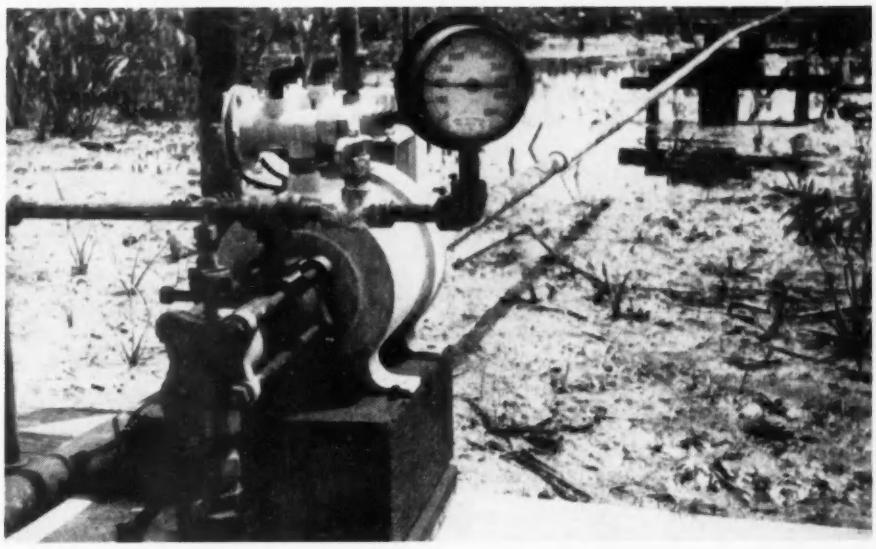
lodged in the tubing. Erratic solubility made the treatment inadequate. Inhibitor sticks compounded today are efficient and are dependable where well conditions permit the well to be closed in for the time required for the stick to reach bottom. (See Fig. 1 for sketch showing a typical stick lubricator installed on a well.)

In time, more attention was given the problem by chemical companies and a number of satisfactory liquid inhibitors were developed that would adequately control the corrosion rate. Use of liquid inhibitors required that the chemical be pumped into the tubing string to be most effective in protecting the equipment from the bottom of the hole to the tank battery.

This method of "slugging" a well entailed the use of a pump that would overcome the well head pressure and pump a sufficient volume of chemical in order that the proper volume of inhibitor was introduced into the tubing as quickly as possible. In some cases, the operator would rig up a truck with a pump operated by the power take-off and equipped with adequate solution tanks. This manner of treatment was effective but had the disadvantages of high initial cost and increased number of personnel.

Pump Problem

A more satisfactory answer to the problem of pumping equipment was to use a small, lightweight, gas-operated pump to inject the inhibitors into the tubing. The need for corrosion treatment on offshore operations, and marsh locations, along with the high cost of motorized equipment made the development of such pumps a necessity. Use of these pumps made possible inhibiting injections that were automatic and flexible. Regular treatments also were possible. As more attention was given to corrosion treatments, various types of hook-ups were made. Trend was toward a completely automatic system that would only require a minimum amount of attention by regular personnel who had only to refill the chemical tanks and observe the operation of the injecting system.



Hookup of injection pump. Gauge shows 500 pounds differential pressure between set pressure of valve and injection pressure. Discharge piping goes to cellar and into casing annulus.

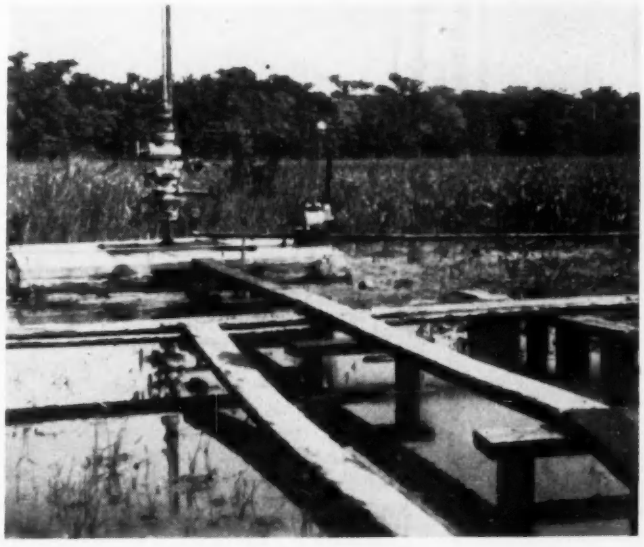
Automatic Hookup

An automatic installation was made on one well where a "shut-in" period was permitted. The hookup was made by installing a direct-operated motor valve (Figure 2) in the flow line. A gas-driven pump was installed and connected directly to the well head. A reverse-acting motor valve was connected to the gas power inlet of the injector pump. Action of the motor valves was controlled by a dual-wheeled intermitter that was formerly used for gas lift operations. A three-day clock was installed on the intermitter and a complete cycle was made over this period of time.

In operation, the intermitter was first tripped and allowed pressure to close valve A and the well was closed in.

After a short interval, the second wheel of the intermitter would trip and pressure the reverse-acting valve on the pump. This would allow the valve to open and start the pump, which would operate for three minutes to pump seven gallons of solution into the tubing. The intermitter would then close and allow pressure to bleed off the diaphragm, thus stopping the pump. After 45 minutes, the first wheel on the intermitter would trip

Here's a 250-barrel chemical supply tank on a Louisiana installation. Enough inhibitor solution is contained here to last more than 250 days. Suction of injector pump hooks directly into supply tank.



General view of Louisiana well equipped with annulus injection system. It is easy to see that motorized equipment would find it difficult to get near this well.

and release pressure from valve A. The well was then opened and production was resumed.

Operation was completely automatic and with the addition of a 250-barrel tank, the only attention necessary was operational checks, winding the intermitter clock and filling the tank. This type installation has possibilities on isolated wells where personnel is a problem and on water locations where regular treatments are difficult due to the transportation problem and adverse weather conditions. It is applicable where well conditions permit the close-in period. Approximate cost of such an installation is shown in Table 1.

Annulus Injection Method

The automatic hookup shown in Figure 2 is not applicable on wells that cannot be closed in because of loading up the tubing. On wells of this nature, the annulus injection method is more satisfactory. This method has been tested extensively on the Louisiana Gulf Coast and has proven itself to be more than adequate.

This type of installation resembles a gas lift completion and consists of a back-pressure valve set two joints above the packer (Figure 3). It is set at a pressure exceeding the static head of fluid in the annulus plus a reasonable pressure to allow for positive pressure to be on the pump at all times. The annulus is filled with the inhibitor solution, and a gas-driven pump is hooked up to the casing head connections. This pump is regulated to deliver the desired volume of chemical solution per day.

When the preset value on the back-pressure valve is exceeded, the valve opens and allows the inhibitor to flow into the tubing. In the event pressure is released by the pump, a check valve installed below the back-pressure valve will prevent the well fluid from entering the annulus.

This type installation assures positive injection of the inhibitor at the

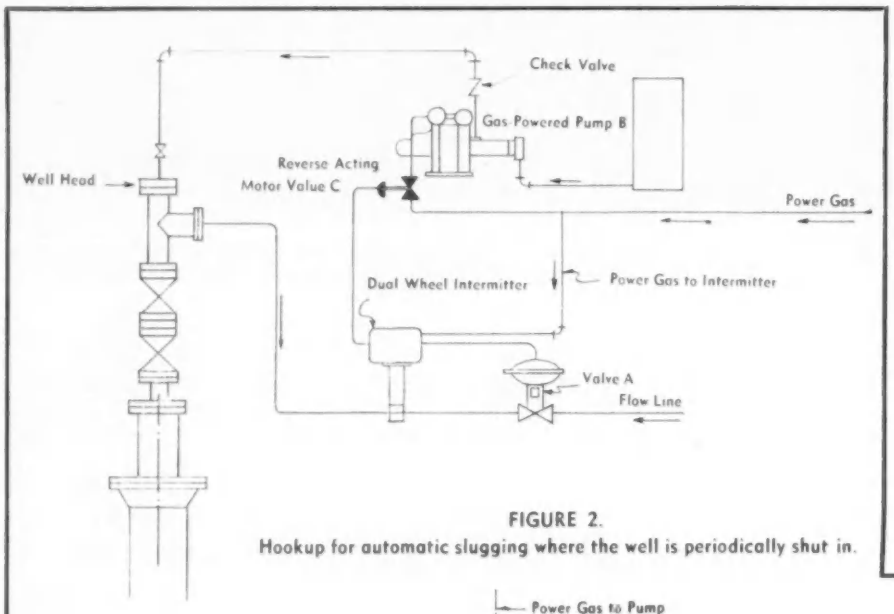


FIGURE 2.
Hookup for automatic slugging where the well is periodically shut in.

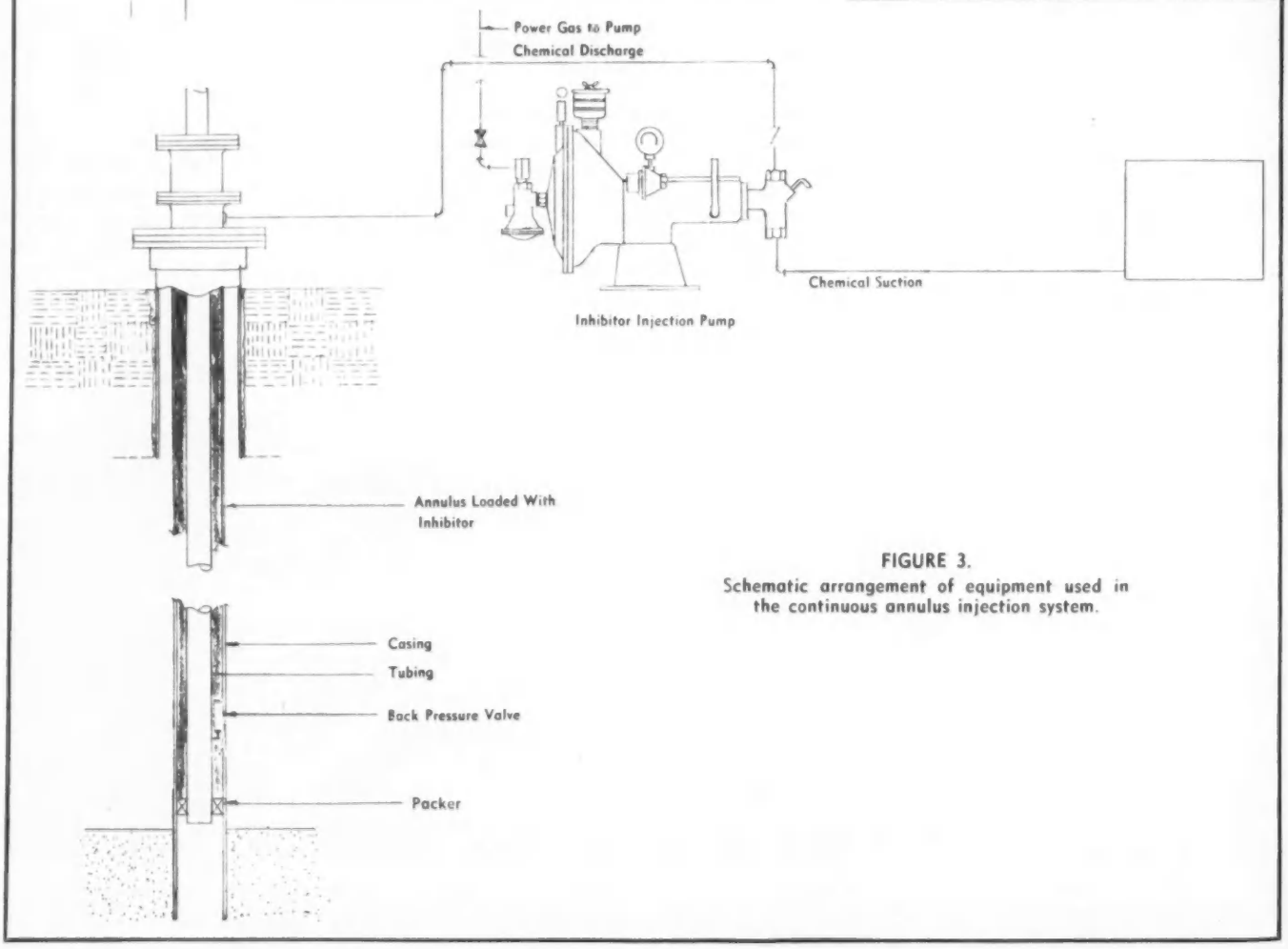


FIGURE 3.
Schematic arrangement of equipment used in the continuous annulus injection system.

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bottom of the tubing string and allows a constant, even coating of the inhibitor to "film" the entire tubing string. Such an installation can be used on any type of well that has a packer set in the string. It has possibilities where the corrosion rate is high on pumping wells for it would assure adequate protection to the tubing and the rods. Approximate cost to make such an installation on a well in the Gulf Coast at a depth of 10,000 feet is shown in Table 1.

The installation shown in Figure 3 was made in a Louisiana well at 10,200 feet. Total depth of the well was 10,300 feet and it is equipped with 2½-inch J-55 and N-80 tubing. Water-oil ratio was about 0.5, the well producing 50 barrels of water to 100 barrels of oil daily.

Tubing pressure was about 1650 pounds, and the gas-oil ratio was 2800. A coupon test showed 0.59 mills per year penetration prior to the annulus injection hookup. The injection valve was set at 500 pounds and an organic inhibitor was mixed with light diesel oil. After the treatment was instigated, the iron content measured only 7.2 parts per million in the produced water. This installation was last reported trouble-free since injection began in February, 1952, and it has been simple, effective and economical.

Gas Lift Wells

Inhibitor injection hookups on gas lift wells is quite simple as shown in Figure 4. It entails mainly a surface installation. Where slugging the line is adequate, a lubricator may be installed downstream of the intermitter valve and periodic lubricating the inhibitor will prove adequate. If a constant injection is desired, a chemical pump may be installed and continuous injection made downstream of the intermitter valve. This will assure a slug of inhibitor solution to be injected into the casing each time the well kicks. When the annulus fills up to the bottom flow valve, inhibitor will enter the tubing to protect it from the lowest valve to the surface.

About the Author

D. J. ELLIOTT, development engineer, Texsteam Corporation, Houston, graduated from the University of Illinois in 1938 with a degree in mechanical engineering. He has for the past five years been closely associated with the sales, service and development of proportioning and ratio pumps, automatic controls and automatic steam generators.

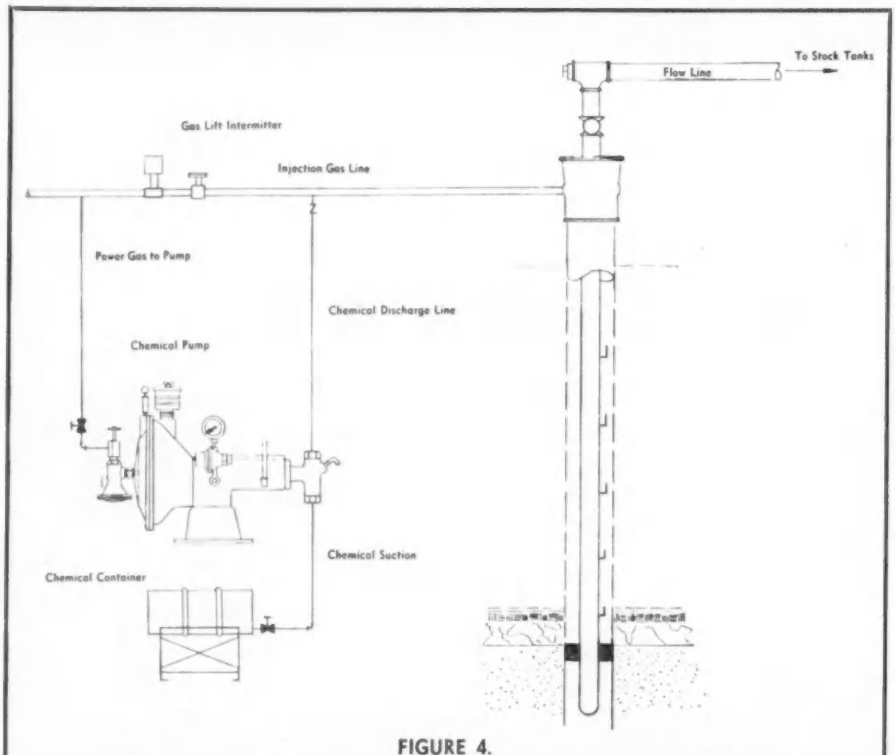

FIGURE 4.
Inhibitor injecting system for minimizing corrosion in gas lift wells.

Surface Protection

Corrosion treatment above the surface on flow lines and lead lines is extremely simple as a lubricator or chemical pump will provide an adequate means of introducing the inhibitor into the flow stream. It should be pointed out that sporadic treatment is inadequate, and if a preventative program is once commenced, it must be scheduled and maintained. Injection methods are preferred over slugging for a constant injection will insure a protective film and will also effect substantial savings in the amount of inhibitor used. Table 2 is a summary of corrosion costs in Oklahoma and Kansas, while Table 3 shows comparisons of costs in corrosive and non-corrosive areas in Oklahoma.

TABLE 1
Cost Estimate on Automatic Hookup Shown in Fig. 2

2" motor valve 5000 psi. w.p. cast steel	344.00
½" motor valve 300 psi. w.p. Bronze St. St. trim	74.80
Dual wheel intermitter	376.00
Chemical pump capacity 2.75 gpm	425.00
Miscl. pipe/fittings	87.00
Labor	50.00
Total	$1356.80

Installation Cost Estimates of Annulus Injection Method Shown in Fig. 3

Workover rig rental	$ 2,250.00
Rigging up time	1,000.00
Rig time	2,875.00
Tearing down	1,000.00
Mud	1,500.00
Pits	250.00
Packer	394.00
Transportation, labor, supervision	2,000.00
Distillate	795.00
Inhibitor	600.00
Back pressure valve	600.00
Pump	198.00
Miscl. valves, fittings	75.00
Above costs based on 10,223 foot well.	$13,537 00

TABLE 2
Subsurface Corrosion Costs and Production Data on Wells in Oklahoma and Kansas

STATE	Oklahoma	Kansas
Wells tabulated	245	76
Water produced, bbls.	55,484	107,600
Oil produced, bbls.	9,722	8,030
Tubing expense	117	689
Rod expense	175	361
Miscl. sub-surface expense	351	55
Total sub-surface expense	643	1,105

All figures based on a per well per year rate. Data taken from paper "Corrosion of Oil Well Equipment" by L. C. Case, ASME Conference on Petroleum Mechanical Engineering, Oct. 6-8, 1948.

TABLE 3

STATE	Oklahoma	Oklahoma
Wells tabulated	8	15
Classed	Corrosive	Non-Corrosive
Water produced	262,184	133,000
Oil produced	20,497	9,300
Tubing expense	$ 363.00	$ 88.00
Rod expense	$1,150.00	$356.00
Miscl. sub-surface expense	$ 484.00	$ 15.00
Total sub-surface expense	$1,997.00	$459.00

All figures based on a per well per year rate. Data taken from paper "Corrosion of Oil Well Equipment" by L. C. Case, ASME Conference on Petroleum Mechanical Engineering, Oct. 6-8, 1948.

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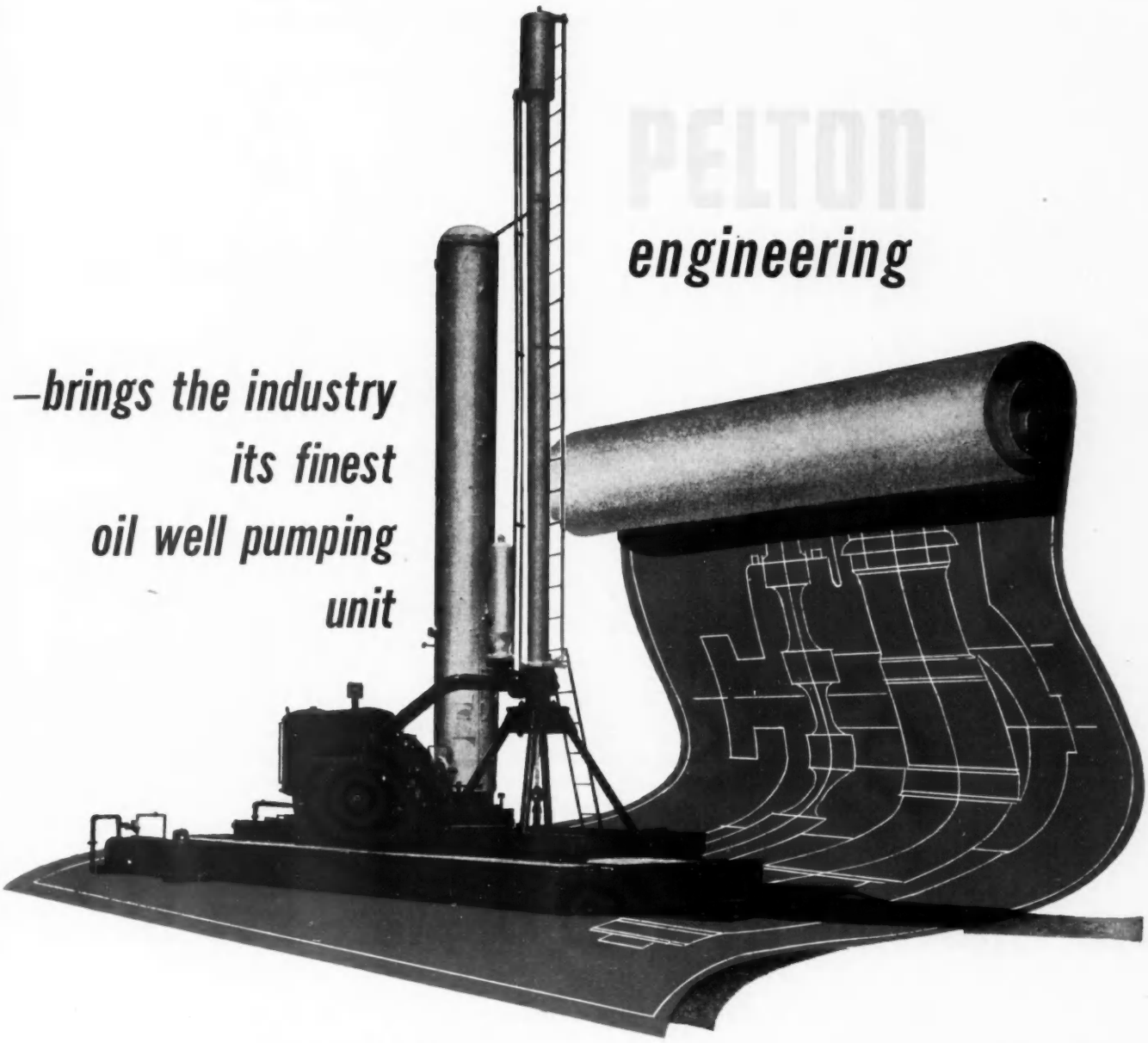
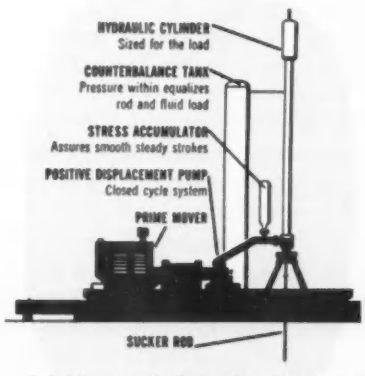


The PELTON *Long Stroke Hydraulic Pumping Jack*



This outstanding heavy duty pumping unit with stroke lengths up to 30 ft. and polished rod loads up to 40,000 pounds produces more oil per day than any pumping means known.

Getting down to cases, a Pelton 30 ft. unit is pumping 925 B/D with a 2-1/4" bore pump set at 8100 ft. Previously, this same well, using a 108 in. Beam Pumper, produced only 400 B/D.

Another case, a 30 ft. unit (on the world's deepest rod pumped well) is pumping 300 B/D with a 1-1/2" pump set at 11,700 ft.

On shallow wells, too, where potential is high, production is being increased 100% and more, over previous pumping equipment.

Here's another point — long slow strokes with soft reversals reduce peak stresses in the rod string resulting in 80 to 90% decrease in rod partings. With less wear on the bottom hole pump, well servicing is commonly reduced 70%.

And what is the cost of Pelton equipment? You will be surprised to learn that the Pelton 10 ft. model "D" Jack, for example, costs considerably less than a comparable Beam Unit. Pelton Jacks are available in 10, 20 and 30 ft. stroke lengths.

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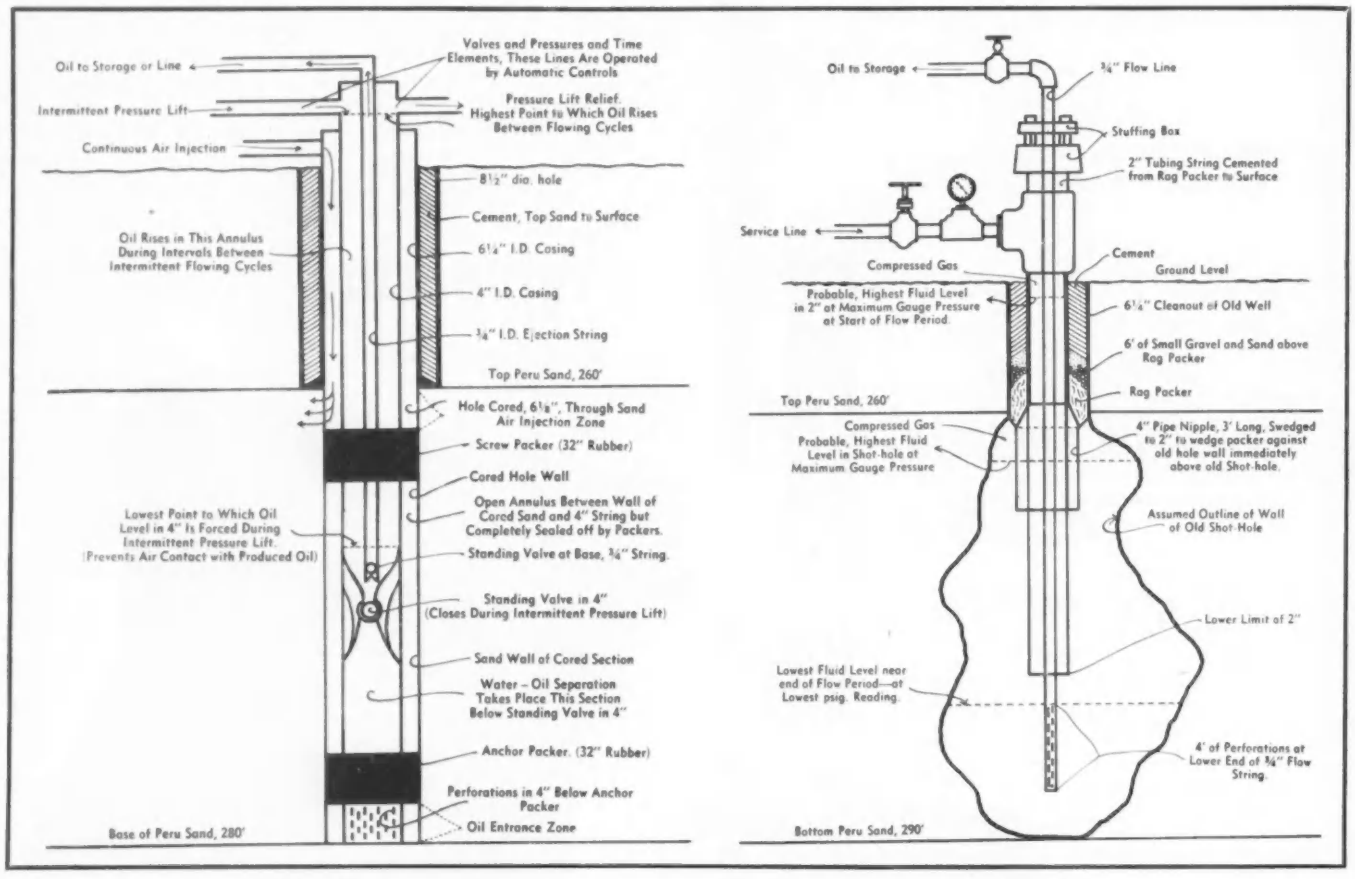

Oil to Storage or Line
Intermittent Pressure Lift
Continuous Air Injection
Valves and Pressures and Time Elements, These Lines Are Operated by Automatic Controls
Pressure Lift Relief. Highest Point to Which Oil Rises Between Flowing Cycles
8½" dia. hole
Cement, Top Sand to Surface
Oil Rises in This Annulus During Intervals Between Intermittent Flowing Cycles
6¼" I.D. Casing
4" I.D. Casing
¾" I.D. Ejection String
Top Peru Sand, 260'
Hole Cored, 6⅛", Through Sand Air Injection Zone
Screw Packer (32" Rubber)
Cored Hole Wall
Open Annulus Between Wall of Cored Sand and 4" String but Completely Sealed off by Packers.
Lowest Point to Which Oil Level in 4" Is Forced During Intermittent Pressure Lift. (Prevents Air Contact with Produced Oil)
Standing Valve at Base, ¾" String.
Standing Valve in 4" (Closes During Intermittent Pressure Lift)
Sand Wall of Cored Section
Water – Oil Separation Takes Place This Section Below Standing Valve in 4"
Anchor Packer. (32" Rubber)
Perforations in 4" Below Anchor Packer
Oil Entrance Zone
Base of Peru Sand, 280'
Oil to Storage
¾" Flow Line
Stuffing Box
2" Tubing String Cemented from Rag Packer to Surface
Service Line
Cement
Ground Level
Compressed Gas
Probable, Highest Fluid Level in 2" at Maximum Gauge Pressure at Start of Flow Period.
6¼" Cleanout of Old Well
6' of Small Gravel and Sand above Rag Packer
Rag Packer
Top Peru Sand, 260'
Compressed Gas
Probable, Highest Fluid Level in Shot-hole at Maximum Gauge Pressure
4" Pipe Nipple, 3' Long, Swedged to 2" to wedge packer against old hole wall immediately above old Shot-hole.
Assumed Outline of Wall of Old Shot-Hole
Lower Limit of 2"
Lowest Fluid Level near end of Flow Period—at Lowest psig. Reading.
4' of Perforations at Lower End of ¾" Flow String.
Bottom Peru Sand, 290'

FIGURE 1.
Essential features of Spearow production method in secondary recovery operations.

FIGURE 2.
Completion for flowing well by Spearow method in secondary recovery operations.

Air Injection Revives Depleted Field

Creation of artificial gas cap reinforces gravity drainage. Unique completion adds to economic success of Kansas project.

By WARD M. EDINGER

Production Engineering Laboratories, Oklahoma City

A NEW METHOD of producing oil from depleted reservoirs is being applied successfully at Osawatomie, Kansas. If current experiments by the Spearow Company, Inc., continue to show encouraging results, this method of secondary recovery may become widely used in areas where conditions warrant application of the technique. Laboratory tests on a scale model of an oil field were gratifying.

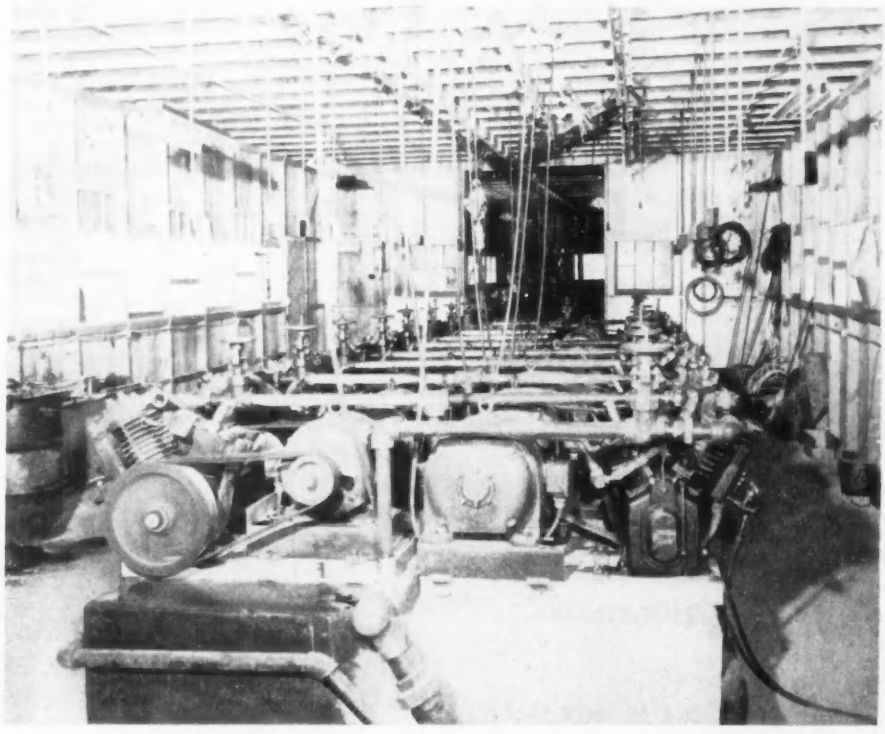
Called the Spearow method, it utilizes several of the aspects of other secondary recovery techniques. In practice, it consists of introducing air or gas into the upper portion of a continuous reservoir, forcing the oil-gas interface to move downward, excepting in the immediate vicinity of the well bore. Here, a change in direction takes place to introduce the fluid into the well. Production is at solution gas-oil ratios.

Intermittently flowing well 800 feet from nearest pressure well, Osawatomie field, Kansas, being produced under Spearow method.

However simple this system may appear, a considerable deviation from conventional methods is brought about by a different utilization of forces. The introduction of air or gas into a closed system, such as a lenticular oil field, brings about an increase in pressure. This pressure is transmitted to all portions of the reservoir and causes a movement of fluids toward the line of least resistance, which in this case

is downward toward the producing level.

The gas or air which is not readily soluble in the crude without agitation or excessive pressures, segregates by gravity and assumes the role of an expanding gas cap. Its direction of flow is toward the higher structural level (especially where gas is injected), at least during the establishment of a gas oil interface. Oil is somewhat compressed in the lower level and a proper counter flow brings about a high saturation at low levels and a low saturation at high levels. Oil is then forced by virtue of the pressure difference between the reservoir and the well bore to move into the well bore where it is expelled or brought to the surface by a proper lift or flow. Other features of this method include taking advantage of the natural gravitational drainage. This drainage is parallel to and supplements the movements described. Removal of fluids from the lower levels upsets the capillary-gravitational balance and the capillary forces are overcome by the vertical forces.



Compressor house on Osawatomie field, Kansas, lease employing 20 three-stage compressors driven by electric motors.

Controlled Production

A natural objection to the method may be raised by the question of how these forces may be brought into play in commercial production practice. It is undoubtedly true that unrestricted production would bring about a saturation distribution that would be far from that necessary to fully utilize the method. Likewise, a "stopper pulled from the sink drain" may force such air down the drain with the water. Nevertheless, a reservoir can be conceived where withdrawal rates are properly controlled in which the mechanism would be active.

Necessary Conditions

Conditions necessary to apply the Spearow method:

- Capillary pressure at the higher level plus the gravity head to the lower level must be greater than the capillary pressure at the lower level.
- Sufficient mobility of the fluids to bring about a downward movement equal to or exceeding the horizontal components near the well bore.
- Sufficient pressure differential to bring oil or gas into the well bore at commercial rates.
- Production of oil at solution or less than solution gas oil ratios.
- Sufficient wells to sustain commercial production.

The further corollary of the method is in connection with drainage radii. Frontal drives and solution gas drives are usually limited to a radius known commonly as the mean effective area. This area in the case of frontal drives rarely exceeds the distance from the furthermost producing well to the input well, since beyond that point the oil is pushed farther and farther away. Likewise, in solution gas drives the area is limited to the distance from which significant rates of production can be drawn. In the Spearow method, the effective area can be considerably beyond the mean effective area since pressures are transmitted to all points in the reservoir and the major movement is downward. Outlying fluids move in a direction normal to the gas cap and thence in a lateral or semi-lateral direction toward the well bore. Thus, by supplying the energy under a properly controlled system, fluids beyond the mean effective area, in its common sense, are delivered to the effective area and produced.

Field Test

The Osawatomie pool in Miami County, Kansas, was selected for initial field application of the new method. The producing horizon in the pool is the Peru Sand topped at approximately 269 feet. It was selected because of its high permeability, presence of an original gas cap, the absence of a prior water drive and limited area.

Several wells were drilled, cored and the cores analyzed. The core

■ CONTINUED ON PAGE 205

TABLE I

Results of Sand Fracturing

WELL	Barrels Oil Used	Pounds Sand Used	Break Down Pressure PSI.	Production Rate Bbl./D.	
				Before	After
Dessert 1	66	2000	1300	2	†
Dessert 2	104	2000	1100	2	30
Bryant 1	176	4000	1100	½	*
Robinson 1 (Old)	66	2000	900	2	7½
Robinson 2	66	2000	1200	Neg.	7½
Hunt 2	66	2000	1100	Neg.	*
Hunt 1 (Old)	45	Oil fractured only	1100	Neg.	*
Bryant 1 (Old)	66	1400	1100	½	*
Robinson 2 (Old)	45	Oil fractured only	1100	None	4.0

* No facilities for testing. † Mechanical failure—no test.

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1. Unique design of motor mount permits proper distribution of load on truck or trailer.
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3. Height, width, weight and length meet most exacting road regulations.
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5. It has heavy tractor type 4 speed transmission, built to take the high torque of the Allis-Chalmers engine.
6. Air operated positive drum clutches are easy and fast for the operator—No Slipping, No Lining—years of trouble free service.
7. Brakes are Cooper patented Air Cooled self-energizing, alloysteel, and center mounted to compensate for expansion. Built in two sizes—36" dia. x 6" wide, or 42" dia. x 8" wide.
8. Eight Line speeds on drum from 47' pm to 815' pm and a maximum line pull of 38,000 lbs. on single line.
9. Line Capacity on 42" drum is 8,600' of ¾", on 36" drum, 6,600 of ¾".
10. All Steel truck bed with plenty of room for air compressor and tools.
11. Telescoping mast with rod hanger and tubing board, which automatically swing into position as mast is raised. Locking dogs automatically lock upper section in place and are tripped from the ground when lowering—No need for a man to be on the pole when setting-up or lowering mast.
12. Mast can easily be dis-connected from unit and left standing and winch unit can be removed from truck in a matter of minutes.

The COOPER—ALLIS-CHALMERS line of servicing winches offers a wide selection of models and sizes. Four sizes of self-propelled tractor units for servicing to 10,000' with one or two drums, six sizes of truck, trailer and skid winches, work-over and drilling rigs with one, two or three drums. There oroper size for any depth.

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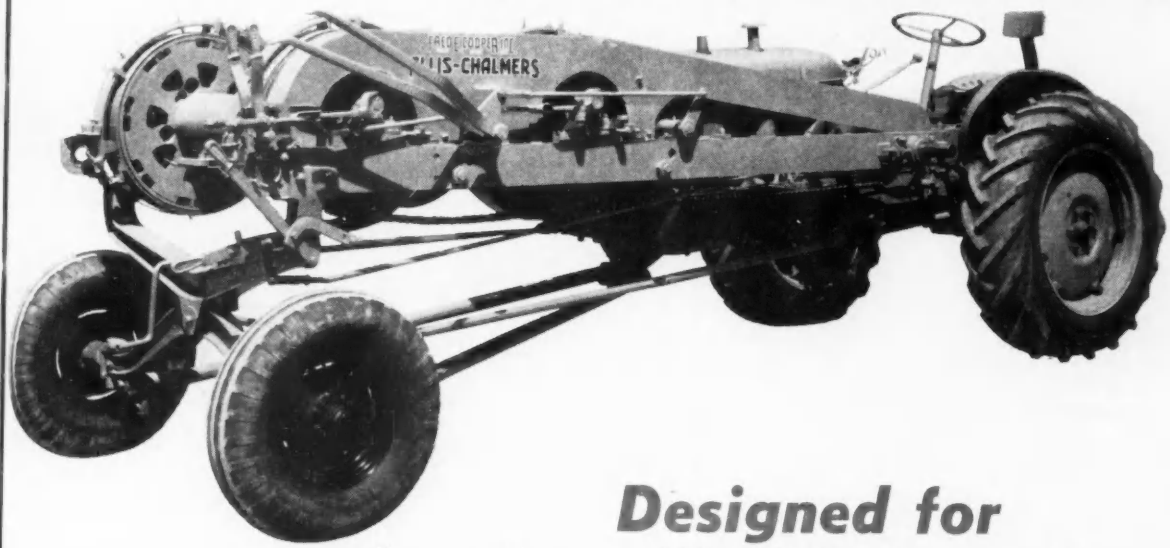
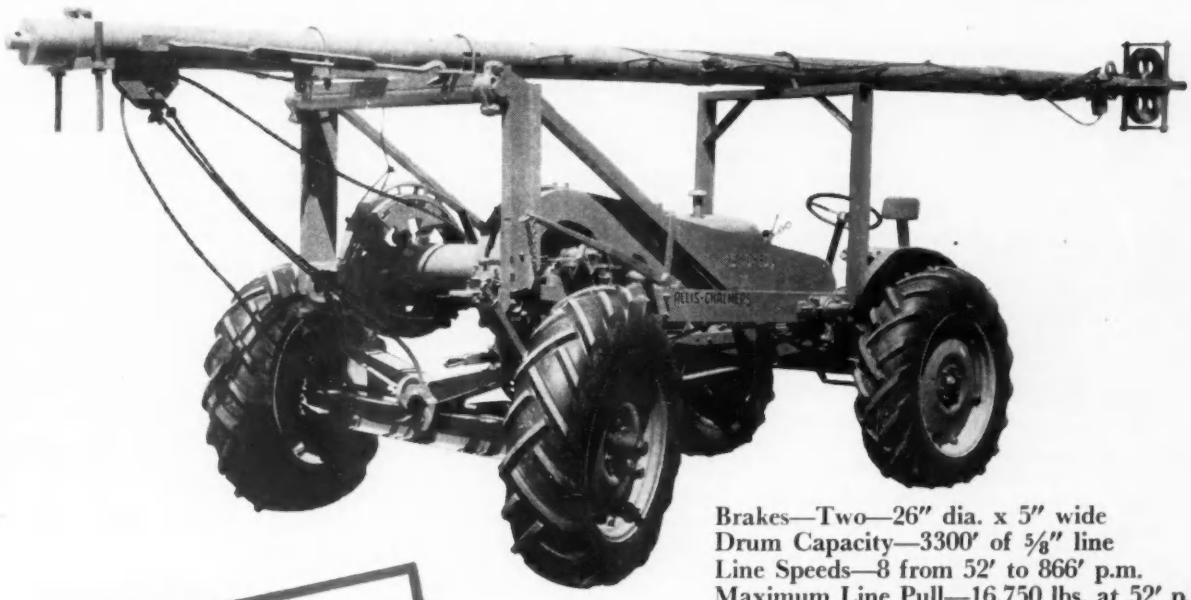


Designed for rough going—Well balanced—Highly maneuverable—Fast.

These units have extremely high axle clearance—yet low center of gravity. Essential to safe operation in hilly country. When equipped with dual rear and mud front tires, these units will operate in the worst conditions of mud and sand. Single or double drum units. Jerk Line Spudder or Rotary Drive for clean-out, and Telescoping Masts are available. Seat Controls (standard equipment). Additional equipment: Front Controls, Metal Cabs, Catheads.



Brakes—Two—26" dia. x 5" wide
Drum Capacity—3300' of ⅝" line
Line Speeds—8 from 52' to 866' p.m.
Maximum Line Pull—16,750 lbs. at 52' p.m.
Road Speeds to 15 m.p.h.

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How Corrosion Costs Cut in Sour Wells

• Yearly expense per well once ranged from $270 in Permian Basin to $2000 in Kansas.

• Here's a report on . . . severity, inhibitors and remedies used in sour crude corrosion and how savings were made.

By J. A. CALDWELL
Humble Oil & Refining Company

WHAT ARE OPERATORS in sour crude areas doing to cut corrosion costs and what is the extent of corrosion severity were among the aims of Technical Practices Committee TP-1D of the National Association of Corrosion Engineers. In many wells in sour-crude areas the replacement of broken sucker rods and completely perforated tubing has been necessary at frequent intervals; in some cases the intervals have been 30 days or less, over an extended period of time. Pumps may have to be pulled at frequent intervals, either because of corrosion of the pump or because of corrosion products from the pipe accumulating in the pump. Failures of flow lines occur, resulting in waste of oil. Reports from certain areas indicate a recent realization of the extent of internal corrosion of casing in the vapor space.

Many of the severely affected wells are pumped to the limits of their productive capacities; therefore, production lost during down time for repairs cannot be made up, and the value of the oil thus lost must be charged against corrosion.

Oil wells which are classified as being in the "sour crude" category may produce gas containing from a trace to several percent by volume of hydrogen sulfide and one percent or more carbon dioxide. Water must be present in the well system for corrosion to occur; in most cases tubing, rod, and pump corrosion becomes serious only after water production has increased to a value of 50 percent or more of total fluid production. The oil itself is not corrosive. However, oils from different fields, and even from different wells in the same field, differ in certain characteristics which have important effects on the extent of corrosive attack; the wetting power of the oil on steel and its emulsifying action with water are two such characteristics.

Copies of a questionnaire designed to obtain preliminary data on corrosion in sour-crude wells were sent by Committee TP-1D late in 1950 to one or more representatives of each of 12 producing companies. Information on the following areas was requested: Arkansas, Kansas, Rocky Mountain and West Texas-New Mexico. Twelve completed questionnaires were received from a total of nine companies.

A total of 8215 sour-crude wells was reported in the survey; of this number 3618, or about 44 percent, were listed as being economically affected by corrosion. A breakdown by areas showed that all of the wells reported from the Arkansas area, 72 percent of the wells reported from the Kansas area, and 36 percent of the wells reported from the West Texas-New Mexico area were listed as being economically affected by corrosion. No corrosive sour-crude wells were reported from the Rocky Mountain area.

Relative Severity of Corrosion. Results of the survey indicated that, in general, rods, pumps and the inside of tubing are the items of well equipment most severely attacked, with the severity probably decreasing in the order given; there is some variance from this order for the individual areas. It was noted that corrosion of casing, both inside and outside, was listed by most companies as being of relatively low severity.

Methods of Control of Corrosion. Of the 3618 wells reported in 1950 as being economically affected by corrosion, 942, or about 26 percent, were being treated with corrosion inhibitors. The inhibitors being used were formaldehyde, organic inhibitors and several additives and wetting agents the names of which were not specified.

No use of protective coatings was reported from Arkansas. They were in use for protection of rods and tubing in four wells in the Kansas area, and 25 wells in the West Texas-New Mexico area. One well was equipped with cement-lined tubing; all other protective coatings were air-dried or baked-on plastic.

There were 212 alloy rod strings, 133 alloy pumps, and 62 alloy tubing strings in service in the areas covered by the survey. It is probable that in some cases two or even three types of alloy equipment were in service in the same well; calculations from figures in the individual reports, however, indicate that a minimum of 337 wells had one or more items of subsurface equipment made of alloy steel.

Economic Aspects. Costs of corrosion in 73 wells in the Arkansas area prior to inauguration of a corrosion control program were estimated at $92,000 per year, or an average of

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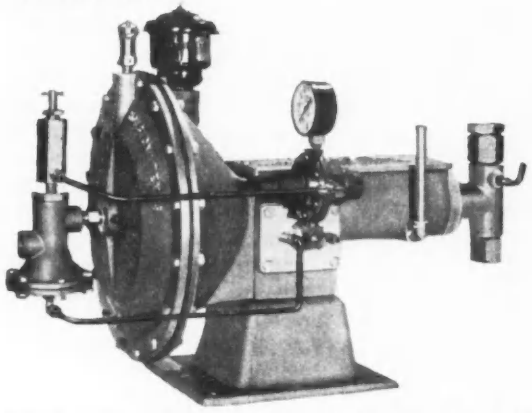

Injection pressures up to 20,000 psi, with volumes from ½ pint to 360 gallons per 24 hours! Here's the *finest* pump for handling chromates and corrosion inhibitors under continuous, high pressure operation.

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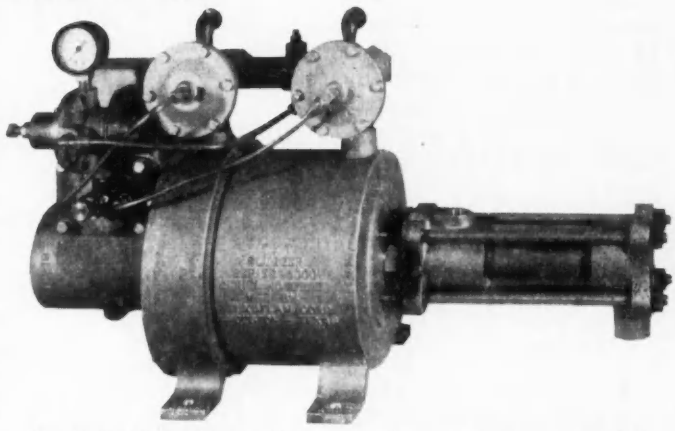

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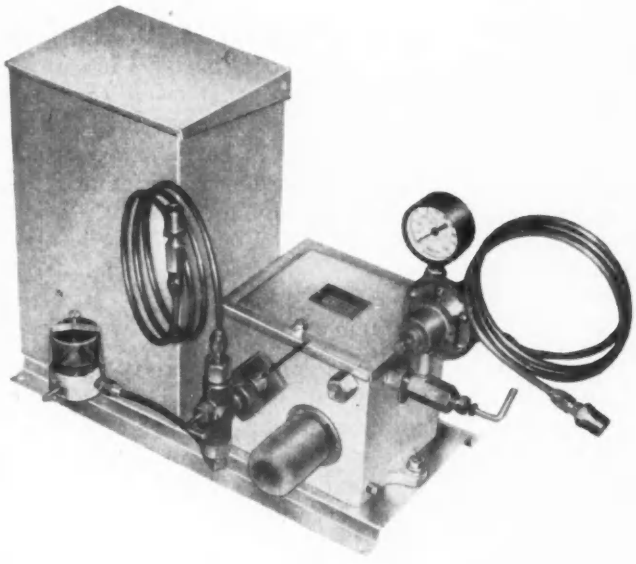

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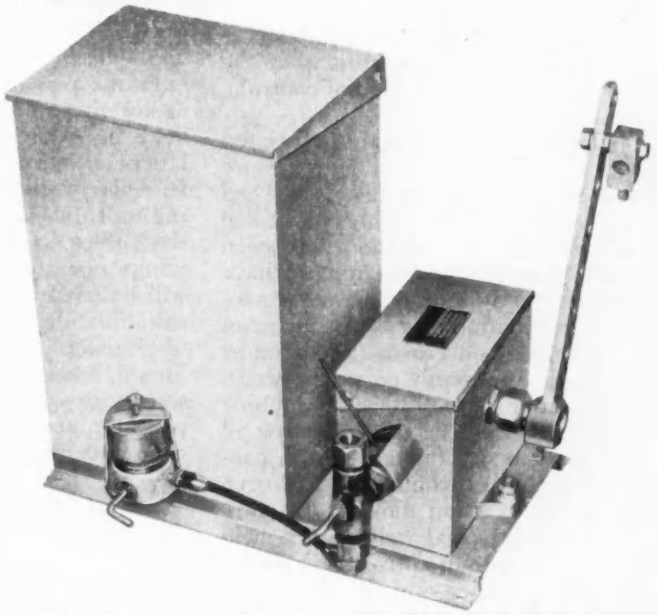
SERIES 1100



These units are designed for operation off walking beams, rod line, rocker arms, etc. Similar TEXSTEAM injectors are furnished with electric motor drive. Both types are furnished with single and double heads.

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about $1250 per well per year. Cost of the control program, plus remaining corrosion, was estimated at $6430 per year or about $100 per well per year.

Cost data are available for only 275 of the 1170 corrosive wells reported from the Kansas area. Calculations show that the cost per well per year before start of a control program was about $2000; after start of the program it was about $225.

In the West Texas-New Mexico area the cost of corrosion was about $270 per well per year; after inauguration of a control program the cost was about $220 per well per year.

Conclusions Drawn From Results of Survey. From the available data it appears that:

1. Corrosion is more severe in sour-crude wells in the Arkansas and Kansas areas than in sour-crude wells in the West Texas-New Mexico area.
2. In general, rods, pumps and the inside of tubing are the items of subsurface equipment most severely corroded.
3. Corrosion of rods, pumps and tubing in sour-crude wells can be substantially reduced by mitigation methods presently available.
4. The use of corrosion inhibitors is considered by operators to be the most efficient method of control.

The potential danger associated with a casing failure in a high pressure well from any cause has long been recognized, but the number of casing failures due to corrosion has been small. However, recent reports have indicated that internal casing corrosion in certain areas is a matter of considerable concern to the operators involved. Apparently corrosion occurs in the vapor space of the casing-tubing annulus in most cases. The cause of the corrosion is thought to be condensed moisture containing hydrogen sulfide and carbon dioxide; gas produced from typical wells in one field where this type of corrosion is known to occur contains one percent hydrogen sulfide and seven percent carbon dioxide. In the Slaughter and Wasson fields of West Texas, several hundred wells may be subject to this type of attack.

Volatile substances such as formaldehyde and anhydrous ammonia are being tested for their effectiveness in controlling vapor space corrosion; one operator has made a one-batch injection of ammonia into each of some 20 wells in one field, and another operator is preparing to start similar injections. An inhibitor is being injected into a considerable number of wells for the same purpose; usually each batch is followed by copious quantities of produced well fluids in an attempt to distribute the inhibitor uniformly over the surface of the pipe.

Performance of Tubing Materials and Coatings

Steel pipe, plain or galvanized and wrought iron pipe have been proved unsatisfactory under highly corrosive conditions in sour-crude wells. A string of nine percent nickel steel tubing in service 30 months in a well in the Howard-Glasscock field in West Texas was reported to have developed pits of depth equal to 30 percent of the original wall thickness and to have failed in several joints by cracking. The normal life of black pipe in this well is nine months. When it is considered that the cost of the nickel steel was about four times that of black pipe, it is obvious that little economic advantage was obtained.

Black pipe coated with air-dried or baked-on plastic has been tested by several operators in the Kansas and West Texas-New Mexico areas with unsatisfactory results in a majority of cases. In a few instances, notably in the Penwell field in West Texas, plastic coatings have shown savings even in pumping wells.

Plastic pipe is being tested for use as tail pipe below the pump in several fields in West Texas. The plastic collars of one installation were found to be severely abraded after six weeks in the well due to vertical movement of the tubing string associated with pump operation; tubing centralizers will be tried in an effort to overcome this difficulty. Several thousand feet of plastic pipe is being tested as flow lines in the same area; reports indicate satisfactory operation during the period of one year in which it has been under test.

Rod Materials and Coatings

Sucker rods coated with an air-dried or baked-on plastic have been tested in relatively few wells; the results to date are mildly encouraging. Nickel-plated rods are satisfactory but are high in cost when available. A test of solid aluminum rods is being made by one operator in West Texas; it is believed to be too early for conclusions to be drawn as to their value. Apparently monel is a very satisfactory material for rods; a string of k-monel rods is reported to have operated for a period of ten years with no failures in a well in the Howard-Glasscock field in West Texas.

Because high-alloy steels are costly when available, and plastic coatings have, in general, been proved to reduce corrosion costs by only small amounts, it appears that the use of inhibitors is the most efficient method of control in sour-crude wells. Inhibitors of the neutralizing type, such as ammonia and soda ash, are unsuitable for use in these wells as a means of reducing corrosion of tubing, rods and pumps because of the troublesome precipitate which would be formed upon contact with the produced water. Formaldehyde has been used in many wells in various fields, with varying degrees of success. Organic inhibitors of the adsorbed-film or oil-wetting type appear to be effective, and to be preferred by the majority of operators. These inhibitors do not cause the formation of scale, can be handled easily in the field, and are available at reasonable cost.

The proper application of inhibitors makes possible the use of black pipe, carbon steel sucker rods, and low-price pumps in very corrosive locations; this is especially important during the present shortage of alloying materials. Because wells vary in severity of corrosive action on subsurface equipment it is impossible to set an exact figure on the cost of inhibitors needed to reduce the corrosion to a satisfactory level. However, for practical purposes it is probably safe to say that severe corrosion in sour-crude wells producing 25 barrels of oil and 25 barrels of water per day can be reduced satisfactorily by the use of inhibitors presently available at a cost of one dollar or less per day.

Summary of Remedial Measures

Because pressures, rates of production of oil, water, and gas, wetting power of the oil, methods of production, acid gas contents of produced gas, and other factors may differ widely even among wells in the same field, it is probable that no simple rule for the alleviation of corrosion can be devised. Some of the steps which can be taken in various corrosive situations with promise of some degree of success are given below. No attempt has been made to list the steps in order of importance.

A. Internal casing corrosion.

1. If feasible, set tubing on packer, fill annulus with sweet or inhibited sour crude.
2. If not feasible to set packer use

volatile inhibitor such as formaldehyde or ammonia, or a proved polar organic inhibitor along with considerable quantities of pipe line oil. The frequency of treatment necessary with this method has not been determined, but should range upward from several months. If the well is subject to tubing, pump, or rod corrosion in addition to internal casing corrosion, inject an organic inhibitor along with considerable quantities of pipe line oil at such intervals as may be dictated by requirements for controlling corrosion of the tubing, pump, or rods.

B. Tubing corrosion.

1. If feasible, inject organic inhibitor into annulus. This will take care of practically all pumping wells.
2. If tubing of flowing well is to be set on packer coat inside of tubing with plastic,[1] or use organic inhibitor in stick form.
3. Use plastic pipe below pump.

C. Rod corrosion.

1. Use k-monel, or 9-12 percent nickel steel, when available.
2. Use nickel-plated rods.
3. Inject organic inhibitor into annulus.
4. Coat rods with plastic.

D. Pump corrosion.

1. Inject organic inhibitor into annulus.
2. In design of pump give consideration to hardness, toughness, and corrosion resistance of various parts.

E. Flow line corrosion.

If pressure is less than 100 pounds per square inch and temperature less than 150° F. use:

1. Plastic pipe.
2. Plastic lined steel pipe.
3. Cement lined steel pipe.
4. Transite or cement-asbestos pipe.
5. Organic inhibitor.

If pressure is more than 100 pounds per square inch, or temperature more than 150° F. use:

1. Plastic lined steel pipe.
2. Cement lined steel pipe, if brine of suitable composition.
3. Organic inhibitor.

ACKNOWLEDGMENT

The author wishes to acknowledge the cooperation of numerous individuals, both members and nonmembers, in the work of N.A.C.E. Committee TP-1D.

Report of NACE Committee TP-1D taken from the August, 1952, issue of CORROSION, through whose permission it is published here.

REFERENCE

[1] Various types of plastics and plastic coatings vary tremendously in their response to changes in temperature and chemical environment.

Air Injection Revives Depleted Kansas Field

■ CONTINUED FROM PAGE 197

analysis was used as a basis for designing proper well completions. Wells were perforated in the gas cap and in the basal portion of the oil column, approximately seven feet apart, when both oil and gas phases were present. A tubing string with a packer dividing the two sets of perforation was run leaving a standing valve at the base. A ¾-inch ejector string was run in the tubing. Air is injected in the annulus and enters the gas cap. The vertical component of this reservoir pressure will, under proper control, cause fluid movement downward and ultimately into the well bore. As the pressure raises sufficiently to open the standing valve, fluid enters the flow string where it is ejected by an air lift.

The desaturation region becomes saturated again under the influence of properly applied and controlled pressure and the process is repeated. Thus the wells, in certain instances, are simultaneous producing and injection wells, when produced intermittently in flow cycles of generally increasing duration.

Well Completions

As shown in Figures 1 and 2, methods of completing wells depends upon whether the well is to be utilized as a combination producer and input or only as a producer. In the case of the combination well, the air is injected continuously between the 6¼-inch and the 4-inch strings into the sand through perforations. Simultaneously, air enters the annulus between the 4-inch and the ¾-inch ejection string to operate to close the standing valve in the 4-inch and eject the fluid column by opening at periodic intervals the standing valve at the base of the ¾-inch string. Oil enters the hole through lower perforations.

Old wells are equipped for flowing by a similar arrangement whereby the air is introduced for the sole purpose of ejecting the oil.

Simultaneous production of oil and injection of gas into the same well is novel in the industry, but practical where there is little structural relief. However, it is obvious that the natural structural features should be taken advantage of wherever possible.

The method has further field application in the matter of producing a water-free oil as has already been demonstrated in the initial field test in the Osawatomie field. It is not uncommon to find extraneous water even in a lenticular oil field by improper plugging of old wells and for other reasons. Under these circumstances the natural differences in gravity act parallel with the ejection system and tend to segregate the water from the oil.

Perhaps the greatest advantage applies to maintaining whatever gas is still in solution in that condition and thereby maintain a higher viscosity, retard shrinkage and enlarge the effective drainage radius.

Compressor Plant

In the initial field application of the Spearow method in the Osawatomie field, pressure was furnished by 20, 3-stage compressors. First stage is 3½ x 2½-inch, second stage 2¼ x 2½-inch, third stage 1 x 2½-inch. Capacity of each unit at 900 revolutions per minute is 25 cubic feet per minute and the compressors are air cooled. They are powered by 10-horsepower, individual air-cooled, three-phase 440-volt motors. Power consumption is approximately 50,000 kilowatt-hours per month. Costs to date have been about 5 cents per thousand cubic feet compressed and delivered at 430-460 pounds per square inch. Compressors are housed in a 20 x 50-foot building adjoining a repair shop measuring 15 x 45 feet.

By the end of the first week in March, 1952, there had been some 44.3 million cubic feet of air injected. Volumetric estimates indicate the pressure should be about 393 pounds per square inch instead of the 200 pounds per square inch exhibited. However, during this period several old wells broke out and dissipated part of the energy. Volumetric calculations indicate some 1504 acre feet of oil-and gas sand exist over some 200 acres. Present air injection is about 500 mcf per day and the shut in pressure is of the order of 256 psi.

While the evidence indicated the field was functioning substantially as predicted qualitatively, commercial production had not yet been established. Several wells were sand-fractured in an attempt to increase production. Table 1 is a summary of these operations. It is estimated from spot tests that when the three wells not currently producing for lack of facilities are included, that the daily production will be of the order of 100 barrels per day. This rate is considered highly satisfactory for the shallow depths and low development and lifting costs.

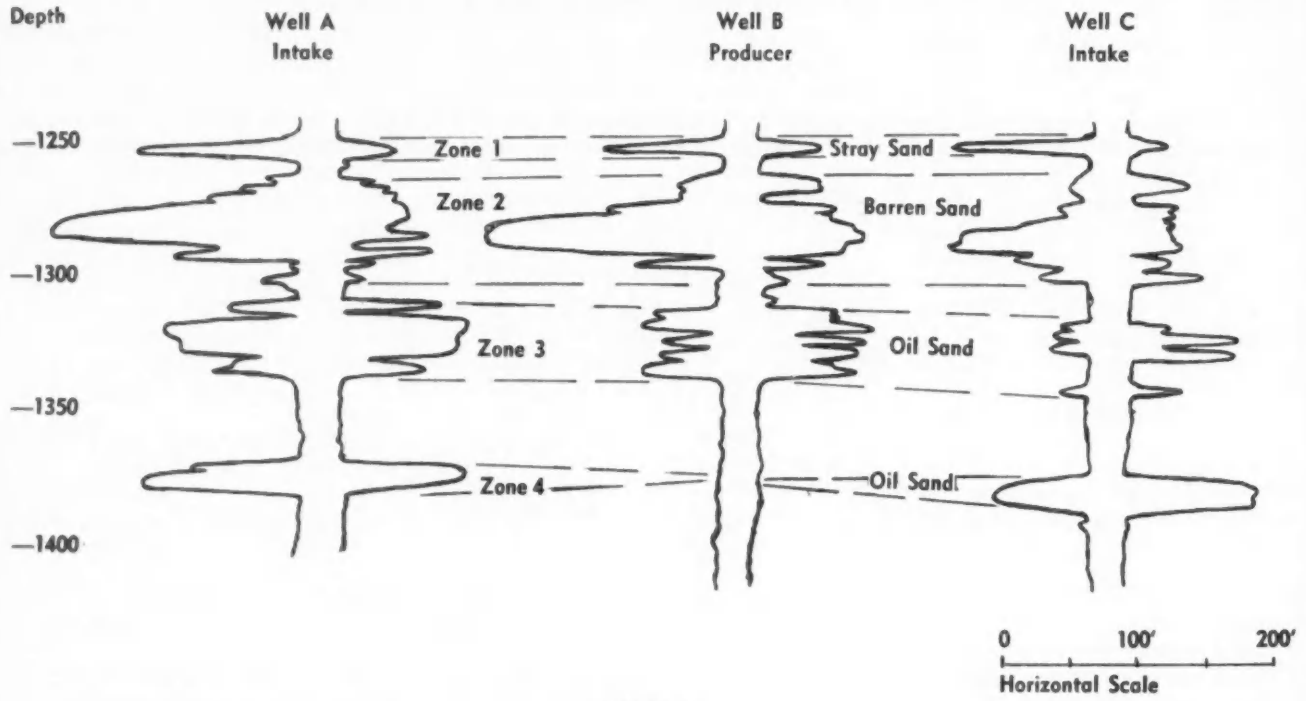

FIGURE 1.
Electric log cross-section showing discontinuity of oil sand.

Water Flood Evaluations Aided by Electric Log

- **Sand continuity easily detected.**
- **Permeability of formation estimated.**
- **Porosity indicated**
- **Oil saturation from S.P. logs.**
- **Connate water saturation computed.**

By MICHAEL COOK
Bradley Producing Corporation, Wellsville, N. Y.

CONTINUITY OF porous formations, porosity, permeability, oil and water saturation can be determined with a high degree of success from electric logs in the evaluation of prospective water flood properties. Core analysis, and now electric logging have made it possible to better understand the complex reservoir conditions and problems which are encountered by the water flood operator. Some of the causes of unsuccessful water floods can be recognized easily by a thorough study of electric logs.

The methods described here for determining reservoir characteristics have been very successful in the Allegany and Bradford fields. No doubt electric logs would make it possible to evaluate similar areas with an equal degree of success.

Sand continuity, porosity, permeability, oil saturation and water saturation are the principal reservoir properties necessary to evaluate a water flood project. It is possible to determine quantitatively these various properties by careful study of the electric log. These problems can be solved by the use of differential resistivity and differential self-potential electric logs.

Interpretation of electric logs in most secondary recovery areas is aided considerably by several factors. With formation pressures generally very low, differential resistivity and self-potential electric logs are readily obtainable. Also available is general knowledge of sand conditions from the primary development such as:

- Type of formation.
- Whether it is a clean or dirty sand.
- Limits of porosity to expect.
- Limits of permeability to expect.
- Possible water and oil saturations that could be encountered.

These factors plus an electric log interpreter familiar with secondary recovery operations will aid considerably in accurate water flood evaluations.

Sand Continuity

The most important factor of a

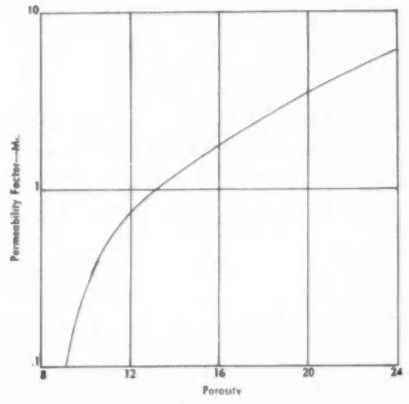

FIGURE 2.
Empirical relationship between permeability to water and porosity for Richburg sand.

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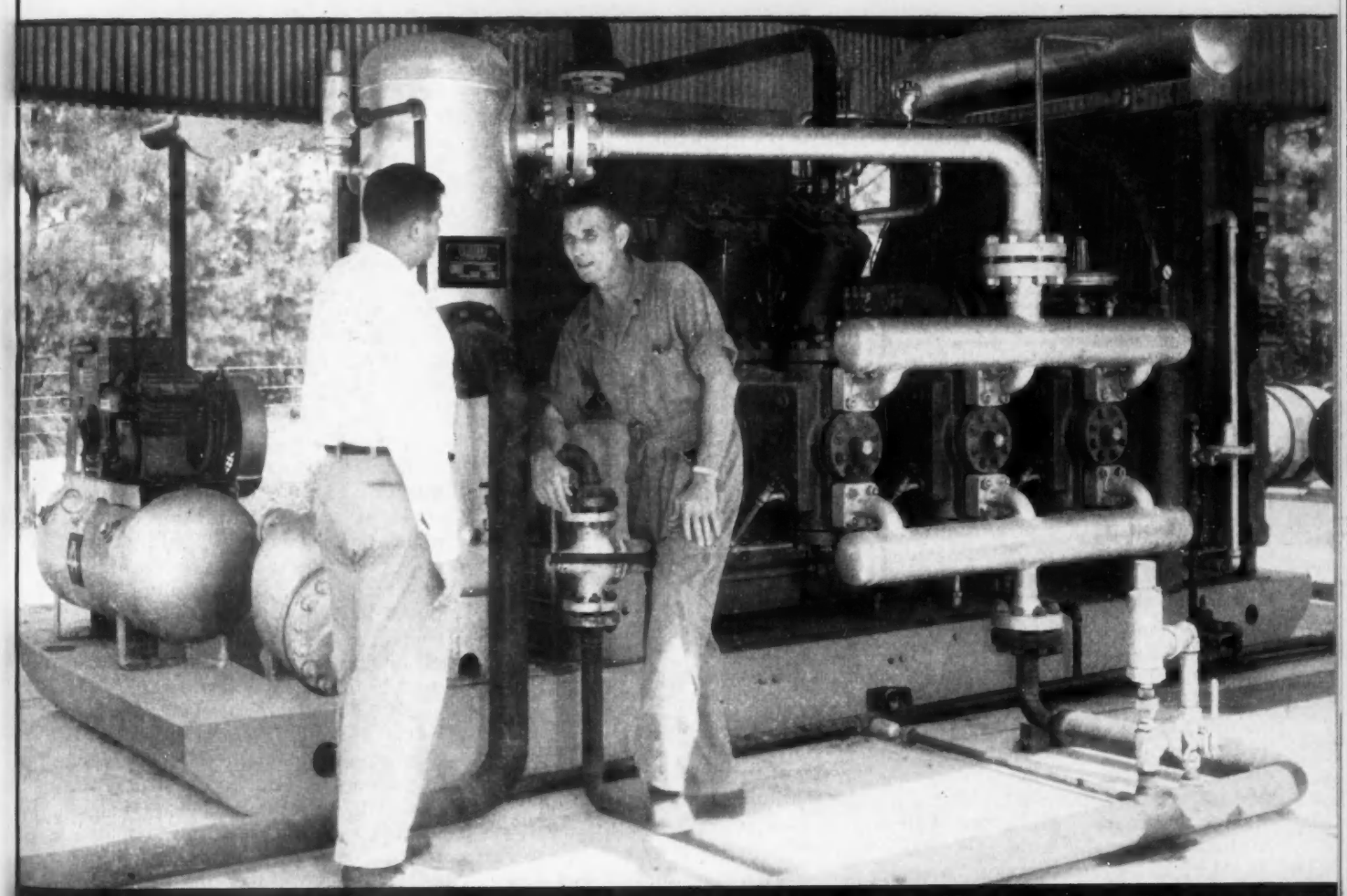

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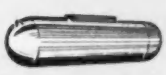

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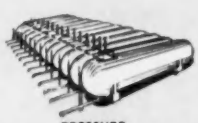


PRESSURE BULK STORAGE

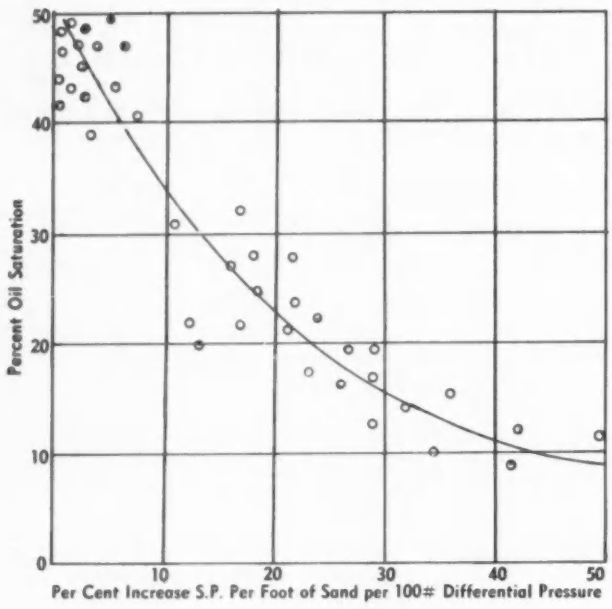


FIGURE 3.
Correlation between oil saturation and differential self-potential taken from core information and electric logs in Allegany field.

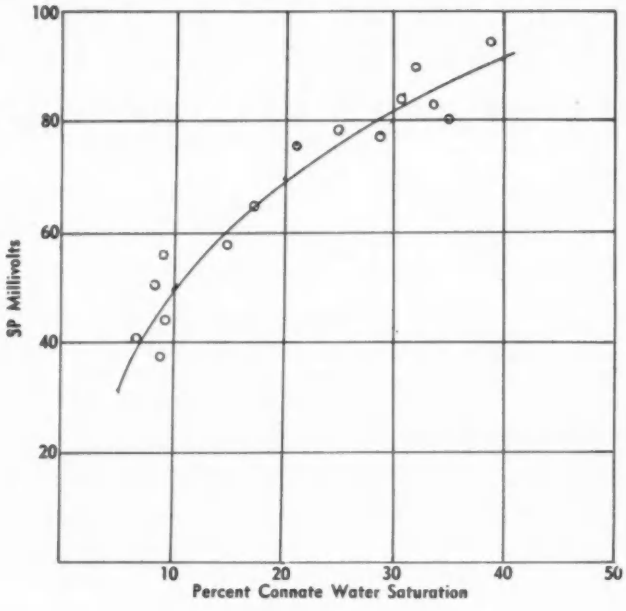


FIGURE 4.
Relationship between S.P. and connate water saturation in Allegany field.

successful water flood is continuity of the oil sand between the water intake and producing wells. It is usually a simple procedure to identify the continuous sand lenses by careful correlation of the electric logs. In doubtful cases, sea level datums should be used to positively identify the producing horizon. In many areas correlations can be made by using marker beds which are easily recognized on the electric log. For example on Figure 1, Zone 1 is prominent on every electric log taken in this area.

Complex lensing conditions may reduce the effective floodable pay sand thickness as shown by the pinchout of sand on Zone 4, Figure 1. It is obvious that this lense will not produce any flood oil in this five-spot pattern. This illustration of a pinchout is a true sand picture of an extreme case but the condition is very common in a lesser degree in many water flood developments.

Zones 3 and 4 as shown on Figure 1 have 29 feet of floodable pay sand at well A, 17 feet at well B and 18 feet at well C, but the effective pay for this five-spot is reduced to 15 feet by the absence of Zone 4 in the producing well. From this actual illustration, the great importance placed on making an accurate sand count of the continuous floodable sand is obvious. An electric log cross-section is very helpful in recognizing sand discontinuities.

Porosities can be estimated from electric logs with considerable accuracy. In the Bradford and Allegany fields a good correspondence has been found between resistivity and porosity after flooding the formation under investigation for a short period of time with water of known resistivity. Logs with a short radius of investigation (single point, shielded mono-electrode with short shields and 4-inch normal) taken before and after flooding are suitable in porosity determinations. It has been found better to calculate the average porosity for each sand lense than to attempt to predict a continuous porosity profile. Keller[1] gives in detail procedures used in making porosity determinations.

Permeabilities

There appears to be a definite relationship between effective permeability to water and porosity in the Bradford and Richburg sandstones of the Bradford and Allegany field. The empirical curve shown in Figure 2 depicting a plot of water permeability versus porosity has been used to predict settled water intake rates with fair accuracy. In a normal five-spot flood where there is no fracturing of the formation or sand face plugging, settled water intake rates as a rule can be predicted with fair accuracy by use of the following simple formula applied to each separate sand lense:

$$Q = PKh$$

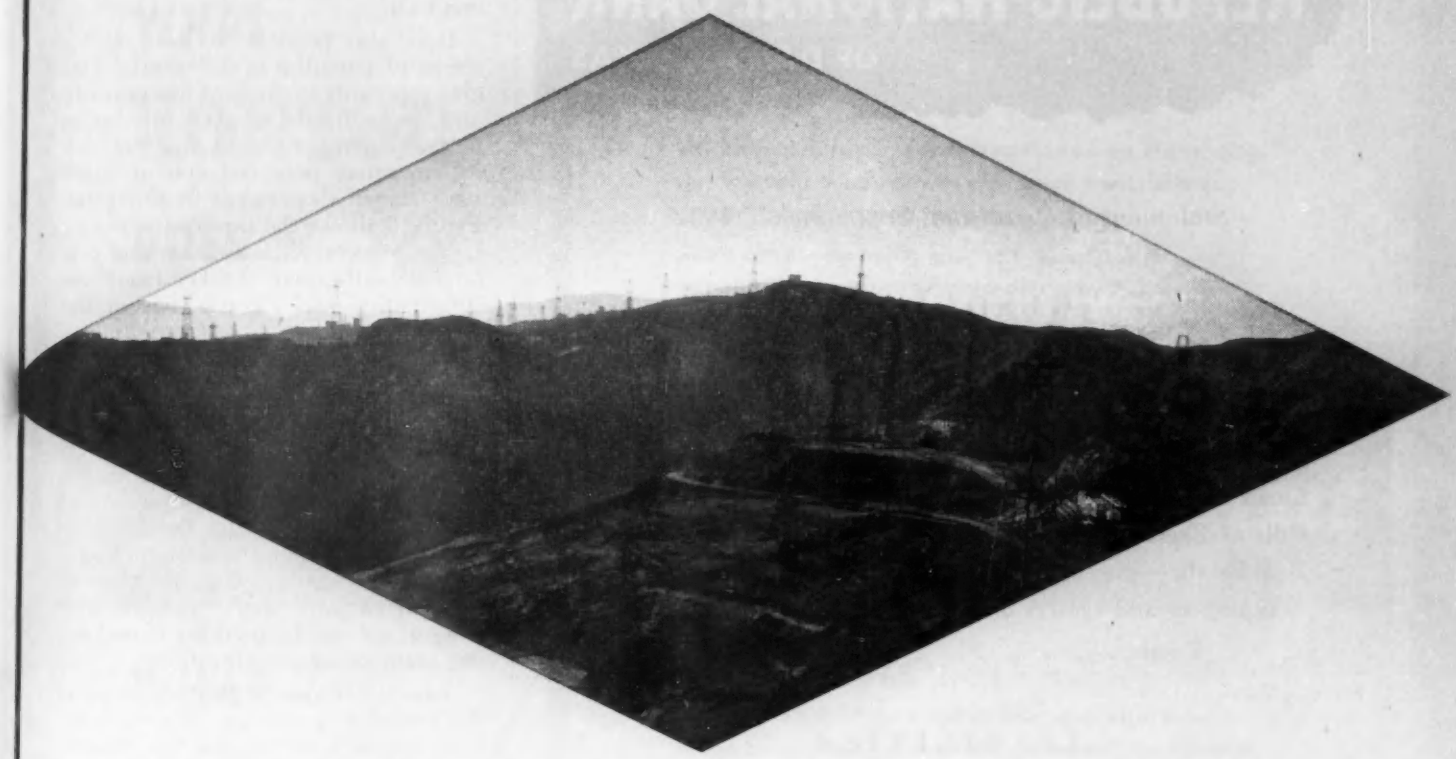
Q = Settled water intake rate bbls. per day.
P = Sand face pressure at intake well.
K = Permeability taken from Figure 2.
h = Thickness of continuous floodable pay sand.

From experience it has been found that porosities below 11 percent in Richburg sandstone have permeabilities too low to be successfully flooded. One must remember the porosity-permeability relationship shown in Figure 2 is not necessarily applicable to other sandstones. A thorough investigation of field performance should be made in other areas before attempting to apply this or a similar curve. There are many factors such as oil saturation, water saturation, swelling of clays, tortuosity, etc., which can effect the permeability of sandstones to water.

Thief Sands

One of the possible causes of failure in water flooding is the bypassing of huge quantities of water through zones of low oil saturation. A dry, highly-permeable thief zone cannot only take a great percentage of the injected water but may also absorb many barrels of oil in a producing well. It is therefore desirable to pack off or seal off thief streaks in all wells used in a water flood project.

These thief sands can be identified by the use of differential self-potential logs which are obtained in the following manner. The first self-potential log is run with the level of the logging fluid just above the formation under investigation. The fluid level is then raised about 250 feet and another SP log is taken. Streaming potentials as high as 150 millivolts have been recorded in the barren sand. To date it has been found that all SP increases over 10 percent per foot of sand indicate a barren sand. The term barren



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RESOURCES

Cash and Due from Banks	$133,499,272.78
U. S. Government Securities	79,811,618.77
State, Municipal and Other Securities	2,939,092.16
Stock in Federal Reserve Bank	1,275,000.00
Loans and Discounts	226,205,602.19
Bills of Exchange and Commodity Loans	13,527,140.27
Real Estate — New Building and Equipment	6,376,179.42
Acceptances and Letters of Credit	4,613,679.93
Total	$468,247,585.52

LIABILITIES

Capital	$ 21,000,000.00	
Surplus	21,500,000.00	
Undivided Profits	5,322,189.78	47,822,189.78
Reserve for Monthly Dividend, Payable October 1, 1951		199,500.00
Reserve for Contingencies		3,306,883.42
Reserve for Taxes, Etc.		4,003,149.52
Acceptances and Letters of Credit		4,613,679.93
Deposits:		
Individual	288,128,786.15	
Banks	108,794,721.80	
Government	11,378,674.92	408,302,182.87
Total		$468,247,585.52

★ ★ ★

Assets of the Republic National Company, with capital stock of $3,000,000 are not included in above statement. The Company owns majority stock in the following banks located in Greater Dallas:

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is here applied to oil saturations less than 35 percent. It is generally agreed that initial oil saturations of less than 35 percent will produce very little flood oil.

It is also possible to have a decrease of potential in differential logging especially in sands of low porosity and low permeability. As a rule, zones below 13 percent porosity have shown no streaming potential and at times have shown decreases in potential. Figure 3 shows the interesting correlation between oil saturation and differential self-potential taken from core information and electric logs in the Allegany field.

Connate Water

High connate water saturations have also been the cause of low oil recovery in water flooding. The engineer or operator should be cautious about initiating a water flood operation in areas where the connate water saturation exceeds 30 percent to 35 percent of pore space. Electric logs here again can be used for determining connate water saturations.

Easiest and possibly the best method for calculating connate water saturation requires the use of the self-potential curve. The log should be taken with the logging fluid 20 or 30 feet above the sand to eliminate the measurement of streaming potential. Figure 4 shows the relationship between SP and connate water saturations found in the Allegany field. These self-potentials were measured in fairly high resistivity (over 5 ohm meter) logging fluid. Connate water saturations in Figure 4 were determined from core samples taken with oil-base drilling mud.

Connate water saturations can also be estimated by use of the resistivity logs. Keller[1] offers a solution for calculating connate water saturations from resistivity logs. The electric log interpreter should use the method best suited to the area under investigation. Regardless of the method used the resistivity of the connate water should be obtained. It is also very desirable to have the connate water saturations established from cores taken with oil-base muds.

Use of electric logs for secondary recovery evaluations should always be considered with all the information available in an area under study, such as: primary oil production, water production and core analysis data as well as the experience gained by similar practice in nearby areas.

REFERENCE

[1] Keller, G. V., and Licastro, P. H., A Progress Report on the Interpretation of Differential Resistivity Logs, *Producers Monthly*, Volume 16, No. 6, 1952.

WHAT KONTOL DOES

KONTOL DOES

Prevent corrosion—by forming a tightly adsorbed protective film on the metal surfaces of production equipment.

Prevent production interruptions—by eliminating the frequent break-downs and equipment failures caused by corrosion damage.

Save time—by being easy to use, by not complicating production procedures, by helping to keep the wells on production.

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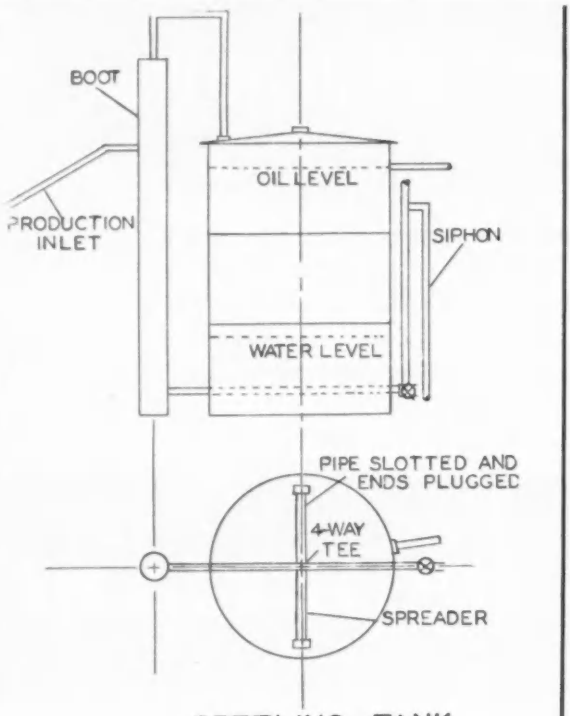

FIGURE 1

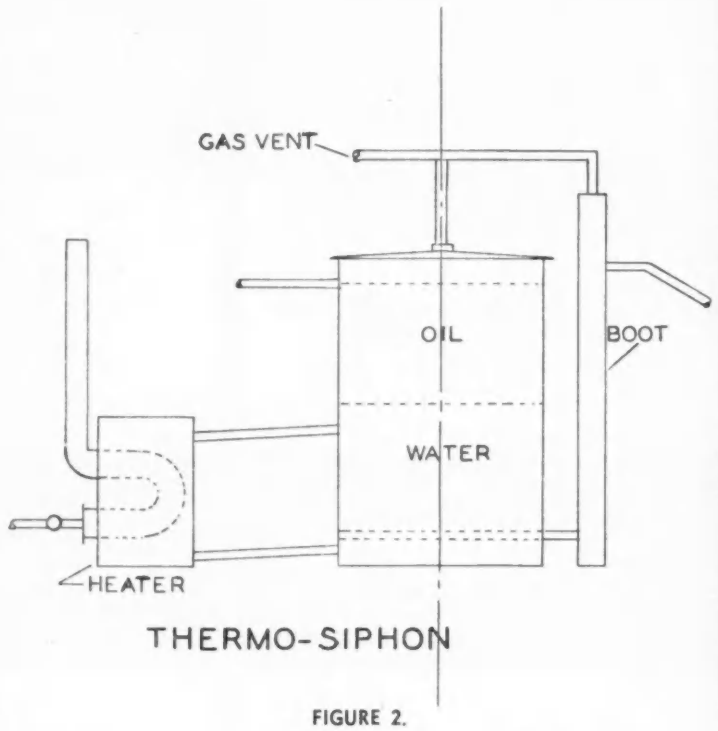

FIGURE 2.

Emulsion Treating Costs CAN Be Cut

Better understanding of the problem and seven simple rules can give you higher quality oil at less expense.

By J. P. EVERETT
Department of Petroleum Engineering, University of Kansas

Two LIQUIDS that won't mix, agitation and an emulsifying agent are necessary for a stable emulsion. Water is found with oil in most producing formations and both flow into the well bore. Agitation can result from bottom-hole pumps, turbulence in the tubing, restrictions in lead lines (gate valves, chokes, fittings, etc.) and gas agitation. The effect of agitation is clearly demonstrated by the fact that emulsification is increased and "tightened" by pump slippage caused by bad cups and worn balls and seats. On some wells there is no emulsion problem when pumping equipment is in good working order. Cut oil produced from these wells indicates a worn pump.

Water and oil, when agitated, will not form a stable emulsion. For stability, the third condition must be met, that is, an emulsifying agent must be present. These agents are surface active and form a layer around the dispersed phase, which prevents the coalescing of the water droplets.

Effective prevention of emulsification can be accomplished only when one of the three conditions necessary for the formation of an emulsion is controlled or eliminated. Since treating compounds are employed to neutralize or destroy the effect of emulsifying agents, they are not a preventive measure but rather a cure. To prevent formation of emulsions, it is necessary to eliminate production of oil and water simultaneously, or eliminate agitation to a sufficient degree to prevent their formation. Since segregation of oil and water, if not impossible, is at best difficult and expensive; the prevention of agitation is then the most logical approach to preventing the formation of stable emulsions.

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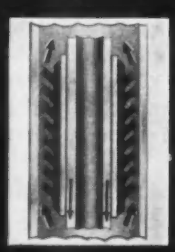
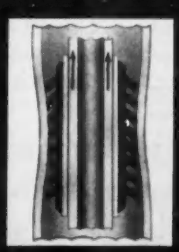
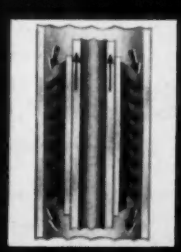


On the down stroke fins are in normal upturned position, allowing E-Z Swab to fall free.

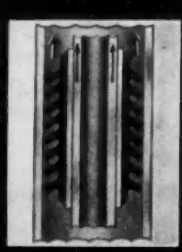
Flexibility of fins allows EZ Swab to pass smoothly through tight spots on up or down stroke.

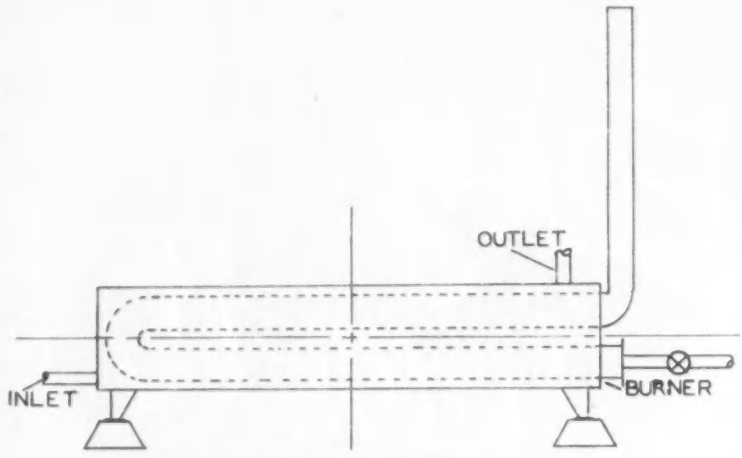




E-Z Swabs automatically by-pass fluid overload. Each rubber will lift approximately 400 feet of fluid. Rubber fins bend down and unload excess fluid.

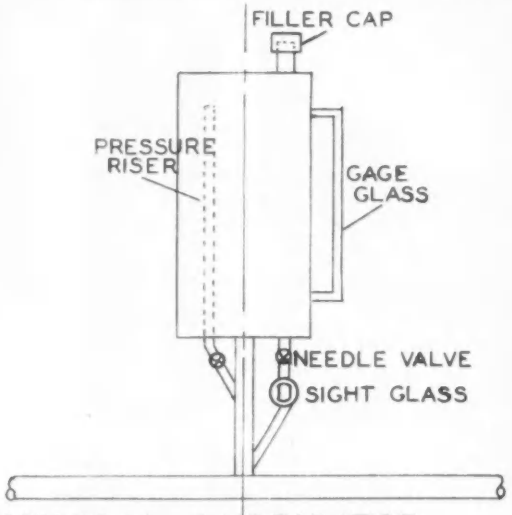
After overload fluid is passed, fins spring up and seal against tubing.





DIRECT HEATER

FIGURE 3.



CHEMICAL LUBRICATOR

FIGURE 4.

control production on a flowing well, most of the emulsion is formed immediately after the fluid has passed through the choke. The greatest pressure drop in the well system will occur at this point and consequently, the turbulence caused by the velocity of the liquid and by the gas coming out of solution will thoroughly mix the water and oil. The sharp temperature drop across the choke tends to "set" the emulsion already formed. In many instances where surface chokes have not proven satisfactory, bottom-hole chokes have been used successfully. Their advantages being: less pressure drop, higher temperature and straight line flow on the downstream side of the choke. Mechanical inconvenience of bottom-hole chokes in some cases more than offsets their advantages.

Most of the agitation in pumping wells occurs in the pump and tubing. Worn plungers, cut cups and eroded balls and seats are the main source of trouble in the pump. When these parts become worn, slippage occurs and fluid leaks by the pump causing a high degree of turbulence and consequently the formation of a tight emulsion. Pounding of a pump will produce whip in the sucker rods causing mechanical agitation in the tubing. To reduce the formation of emulsions in a pumping well:

(1) Keep plungers within close tolerances.
(2) Use oversize standing and traveling valves.
(3) Use proper speed and length of stroke.
(4) Place traveling valve at bottom of plunger and space as near the standing valve as possible.
(5) Keep the volumetric efficiency of the pump as high as possible.

Above Ground Emulsions

Many emulsions are caused by improper handling of well fluids after they are above ground. When gas presents a problem, it should be separated from the liquid as near the well as possible. Lead lines should be of sufficient diameter to carry production with as little agitation as possible.

In instances where the water and oil come from the well "free," it is advantageous to include a free water knockout near the well head. This precaution will eliminate the formation of emulsions farther down the line.

Principle factor in combatting the formation of emulsions is to decrease agitation and turbulence wherever possible. Although all precautions are taken, in many instances emulsions will form. When such emulsions are formed, it becomes necessary to separate the water from the oil by treating.

Treating Emulsions

The producer, in treating oil, will probably include one or more of the following procedures:

(1) Allow settling time and provide for disposal of water.
(2) Apply heat to the emulsion.
(3) Operate some mechanical or electrical devices such as gun barrels, hay tanks, centrifuges or electrical dehydrators.
(4) Add chemicals.
(5) Reduce viscosity by addition of diluents.

Settling time is necessary in any method of emulsion breaking and in most instances, pipe line oil can be obtained from settling alone. If an emulsion is allowed to remain undisturbed in a tank, the water will settle to the bottom and leave the water-free oil on top. Speed of settling depends upon: oil viscosity, the density difference between oil and water, and the size of the water droplets suspended in the oil. All mechanical and electrical devices, chemicals, and heat

About the Author

J. P. EVERETT graduated from the University of Oklahoma in 1948 with a B. S. degree in petroleum engineering. He received his master's degree in 1949. From September, 1949 to August 1951 he was a member of the staff at Oklahoma A. & M. College, Stillwater, and in September, 1951 he joined the staff at the University of Kansas in the Department of Petroleum Engineering. During the summer of 1950 he taught an A.P.I. Course in "Treating Oil Field Emulsions." He served nearly four years with the U. S. Coast Guard. two years of which were with the civil engineering branch, 5th Naval District.

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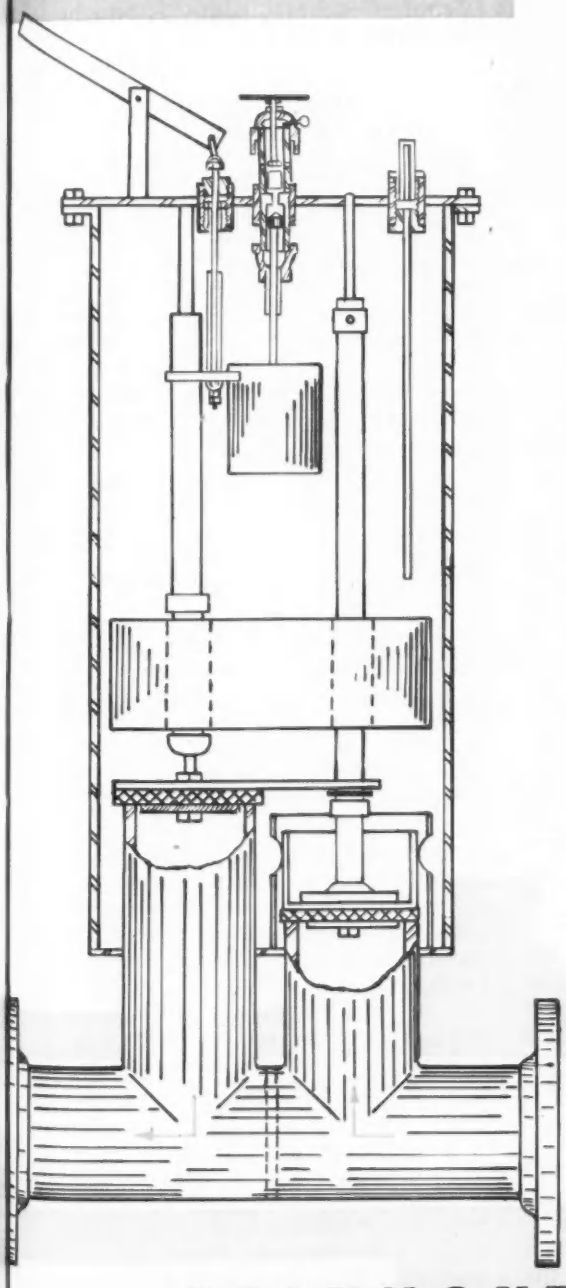

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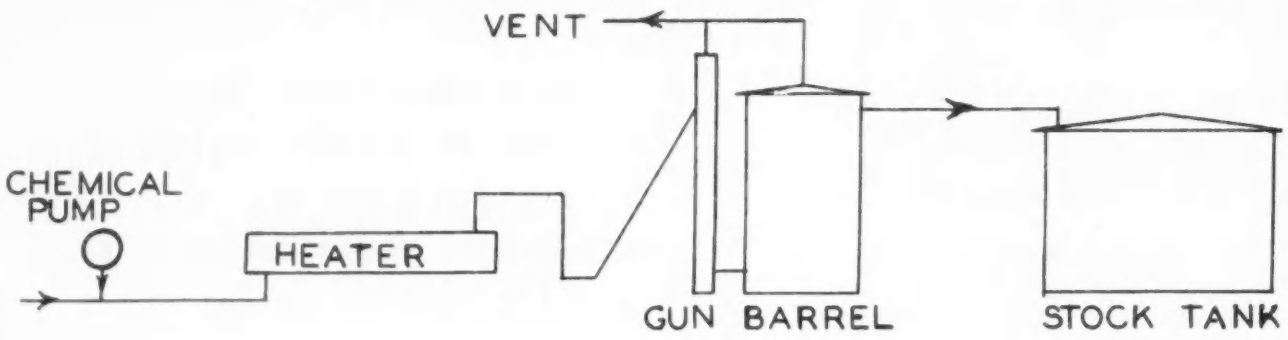


FIGURE 5.
All phases of chemical treatment are shown in this typical lease hookup.

are designed and used to speed the settling process.

Settling tanks as shown in Figure 1, are widely used in older producing areas. Advantage of this type tank is the economy of construction; all parts except the tank can be made from material usually found on the lease. Disadvantage is the lack of provisions for conserving light ends. However, where settling problems are simple and economy a prime factor, this type tank is useful.

Heat can be applied to the emulsion in various ways. A simple device is steam coils in the bottom of wash tanks. This method is not suitable unless steam is available from a nearby boiler. Although popular a few years ago, the steam-coil system is now used primarily for extremely low-gravity crudes. Another means of applying heat to the water in the wash tank is the thermo-syphon system (Figure 2). This system operates on the principle of density difference. Cool water enters the heater at the bottom and is heated. Hot water passes out the top of the heater and enters the tank. The pressure differential causing flow is small, and in order to have efficient operation, the following rules should be followed:

(1) Use at least 4-inch pipe for inlet and outlet.
(2) Do not use any check valves in the system.
(3) Slope both lines downward to the heater.
(4) Inlet line must enter below the oil-water contact.
(5) Use as few pipe connections (ells, tees, etc.) as possible.

If these simple rules are followed, a thermo-syphon should give long trouble-free service. If the produced water is very corrosive, fresh water can be circulated through coils. Also, if circulation is too slow, a small pump may be placed on the water inlet line.

Another and most common method of heating oil is an in-the-line heater. This type of heater can be divided into two groups—direct heaters and indirect heaters.

In a direct heater, the fire comes in contact with the pipe carrying the oil. One type operates like a refinery still. Tubes carrying oil are suspended in the firebox and connected by return bends. Another type has a fire tube through the center surrounded by an emulsion in the annular space (Figure 3). The latter, although not as efficient as the former, is less expensive, and if fuel cost is not important, will heat the emulsion effectively. A volume or "jug type" heater is similar to the direct-fired tube heater except it has a larger volume around the tube which is usually filled with water. Emulsion enters the bottom under the fire tube through a spreader, rises through the hot water and is taken off near the top. The jug-type heater combines the advantages of a direct heater and a water wash. Also its larger volume tends to smooth out temperature changes due to intermittent flow. A thermostat controls the temperature on both direct and indirect heaters.

Indirect heaters do not have the fire box or tube in direct contact with the emulsion. The fire tube is surrounded by water and the emulsion passes through a bundle of flow tubes immersed in the heated water. This type heater is especially adaptable to highly corrosive oils.

Although an aid in treating, heat alone is not sufficient to break an emulsion. Too much heat is detrimental in causing loss of volume and gravity of the oil and shortening the life of the heater. The proper temperature should be determined in the laboratory before a heater is bought and installed.

Electrical dehydration is accomplished by bringing the emulsion into the field of a high-potential alternating current. This electric potential disturbs the equilibrium of the droplets and allows them to unite. With the formation of larger droplets, the water will settle out and can be drained off. As in other treating methods, heat applied to emulsions will decrease settling time. Electrical dehydration is advantageous in that light ends can be conserved since the dehydrator shell is vapor tight and can operate at high pressures.

The effect of gravity separation can be increased many times by use of a mechanical centrifuge. The centrifuge bowl rotates at a high speed and emulsion is injected near the bottom through a down-pipe Water, being the denser of the two fluids, moves out to the perimeter as it moves upward to the outlets. Oil is removed from an overflow near the center of the centrifuge while water comes out near the outer edge of the revolving bowl. To remove any solids from the centrifuge, such as sand, it is necessary to stop the centrifuge and clean it out by hand. Centrifugal separators can be placed in a system using chemicals and heat in order to speed the separation. In areas where electricity is available, centrifuges can be powered by electric motors. On a cost-per-barrel basis, the centrifuge compares favorably with other methods of separation.

Chemical Treatment

The most common method used in breaking emulsions in the field is by the use of chemicals. Chemicals are used to counteract the effect of an emulsifying agent. It would be impossible to list all chemical compounds

for treating emulsions that are on the market today. A few used are: phenol, cresylic, oleic, and stearic acids; sulphonated organic compounds, sodium oleate and sodium resinate.

Chemical treating normally is used in conjunction with heat and some mechanical device. As stated before, agitation is one of the necessary conditions for emulsion formation. However, when chemicals are injected into the system, agitation is necessary to secure good mixing of the chemicals and emulsions. Therefore the best results are obtained when chemicals are injected into the fluid stream as soon as possible, preferably near the well head. Early injection serves two useful purposes:

- It allows thorough mixing.
- Since emulsions tend to "tighten" with time, it shortens the time lapse between emulsion formation and emulsion treatment.

In a continuous operation, chemicals may be injected into the flow stream either by a lubricator or a pump. The lubricator (Figure 4) is a simple device and many home made ones are found in older-producing areas. Main advantages of lubricators are simplicity and low cost. Disadvantages are:

(1) Clogging due to sticky chemical deposits.
(2) Clogging due to foreign substances in the chemical compounds.
(3) Need for regulation of flow when temperature changes (viscosity low at high temperatures and high at low temperatures).

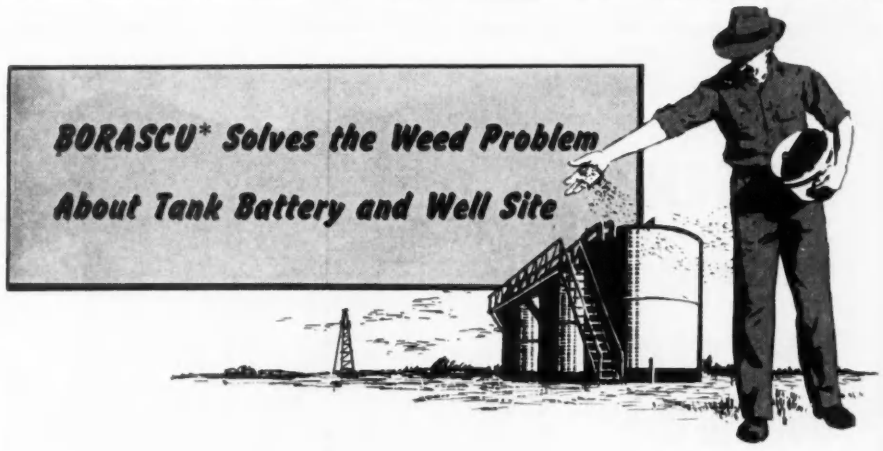
Chemical pumps are of the positive-displacement plunger type Power for operation can come from any one of several sources:

(1) Positive-displacement drive using gas pressure.
(2) Diaphragm-operated drive using gas pressure.
(3) Turbine drive using gas pressure.
(4) Direct drive operated from the beam on a pumping well.

Another method of injecting chemicals into a fluid stream is by down-hole treating. This can be accomplished by loading a lubricator with oil-diluted chemicals and dumping them into the annular space in batches. The best application of down-hole treating is when a rodless reciprocating hydraulic pump is used. Chemicals can be injected into the power oil and carried through the pump. This down-hole treating not only gets the chemical in the oil at an early time but even more important, it takes advantage of the higher temperatures at the bottom of the hole.

In some instances wells will produce relatively clean oil when pumping equipment is in good mechanical working order, but will start producing an emulsion when the pump begins to wear. Other oils present no treating problems when temperatures remain high, but will emulsify when temperatures drop. In either case it is not necessary to employ a continuous treating method, and treating in batches can be used to advantage.

If much oil is to be treated, the batch system is probably the most expensive and least effective; however, the initial cost is low and the question of batch treating versus continuous treating must be answered on an economic basis. A common method for treating oil which has been turned down by the pipe line company is to add chemicals directly to the tank and then "roll" the tank with gas pressure to insure mixing. After rolling, the water is allowed to settle to the bottom of the tank and can be drained off. Steam can be used for agitation instead of gas. Steam has the advantage of adding heat to the



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emulsion, but it also has the disadvantage of introducing fresh water which may result in a tighter emulsion than the one originally encountered.

Another method of batch treating uses a circulating system. Chemicals are added to the emulsion either by a drip bucket or an injection pump. Emulsion is then pumped out of the storage tank, through a heater and back to storage through the top of the tank. This type of treatment is easily adapted to a portable unit. A portable unit is mounted on a trailer and should consist of the following:

(1) A heater to heat the circulating emulsion.
(2) A chemical injection pump.
(3) A pump to circulate the oil.
(4) A gas engine to operate the pumps.
(5) Flexible hoses to make the necessary connections.

Gas to operate the heater and engine can usually come from the separator vent line. Such a portable unit is an excellent method for treating tank bottoms. In such recovery operations, it is not unusual to get 70 to 80 percent pipe line oil recovery.

Integral System

A schematic drawing of a typical lease hookup is shown in Figure 5. It combines the separate steps into an integrated chemical treating system. A logical development in chemical treating was the introduction of the heater-treaters which combine in a single compact unit:

(1) An oil and gas separator.
(2) A heater.
(3) A water-wash.
(4) A free-water knockout.
(5) A stabilizer.
(6) A filter section.
(7) A heat exchanger.

A few simple rules and remedies will eliminate much of the trouble and expense of treating.

(1) Treat each emulsion-producing well as an individual case. Have the emulsion treated and tested and do not apply the test on one well to others in the area.
(2) Analyze the treating problem and decide on the system to be used.
(3) Do not sacrifice volume and gravity by using too much heat.
(4) Do not over-treat. Chemicals are expensive and addition of chemicals over the needed amount accomplishes nothing.
(5) Keep injection pumps clean and in good repair. Failure of a chemical pump to operate will cause tanks to be turned down and necessitate batch treating. It is good practice to have reserve pumps that can be exchanged when a pump is out of order. This practice allows time to clean and repair the pump with no down time on the well.
(6) Regularly inspect units in treating system. Heaters should be inspected for scale and sludge and cleaned when necessary. Hay sections should be inspected and replaced when they fail to function properly. Burners should be inspected and cleaned and adjusted when necessary. After a few months, frequency of necessary inspections can be determined and scheduled to avoid neglect.
(7) Have emulsions tested frequently. Emulsions can vary a great deal over a period of time.

If these rules are followed, there will be less expense to operators and less trouble for the men in the field.

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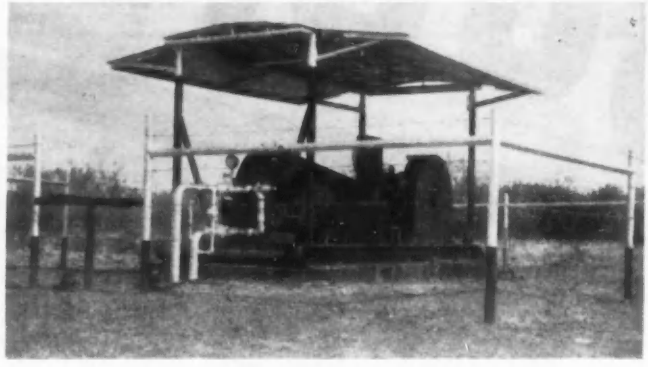
This Water Flood Pump Is Flexible



Semipermanency of some waterflooding projects makes it necessary to plan in advance to minimize costs of moving equipment when the flood has been completed. By unitizing pump and engine on a common skid, not only are installation costs reduced, but moving the equipment from the location in the future will also be cheaper than moving separate units.

In selecting a plunger type pump for small waterflood projects or for pilot floods, it was recognized that the relatively short life of the projects requires equipment that can easily be moved and yet be sturdy enough for continuous operation. A common oil field plunger pump and single-cylinder gas engine are mounted on skids as shown. For safe operation, the flywheel and connecting V-belts are enclosed by guards.

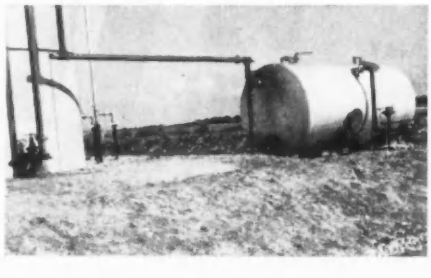
Several features commonly seen around drilling rigs are used to unitize this equipment and partially shelter it from the weather. A steel roof was made in three sections in order that the two outside sections would fold along the sides when transported. A toolbox was spot welded on the heavy screen flooring to store spare parts and a few hand tools. Since the equipment would probably be used continuously for a few years at each location, a concrete foundation was poured and a fence with a turnstile gate was constructed. The pump is equipped with the normal safeguards for proper operation. Pop valves on the discharge line prevent excessive pressures, and a bypass between suction and discharge permits easy engine starting. Suction and discharge lines from the pump are equipped with hammer unions for quick connections and ease in breaking the line for a move.

Skimming Tank Stops Pollution

On many locations, it is not feasible nor practical to flow separated salt water into evaporation pits or into special salt water gathering lines. Where the produced salt water can be dumped into bays or inlets, it is essential that all traces of oil be removed prior to allowing the salt water to empty into such bodies of water.

A skimming tank connected to the water leg of a gun barrel tank will assure a oil-free water for disposal into public waters such as a bay or inlet. Essentially, the skimming tank is a separator itself, operating at almost atmospheric conditions, but with a slight amount of pressure to cause the water to flow through the discharge lines into the bay.

This tank, measuring about 8 by 20 feet, was placed on a concrete foundation adjacent to the tank battery.

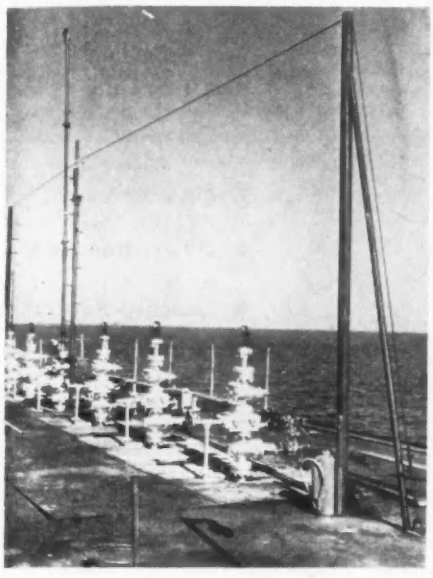


Salt water flows freely into the skimming tank where any traces of oil are allowed to rise to the surface of the oil-water interface. Oil is automatically dumped from the upper levels of the tank, while the salt water is taken from the far end at the bottom of the tank. Connections are made to completely bypass the skimming tank in case repairs or adjustments are required.

Skid Foundation Bears Generator

After being delayed by deep mud and soft sand which affected the setting of a generator unit, a foundation was constructed for this unit

which will support the generator upon any soil condition. Two deep troughs were made by welding flat sections of steel to a base to carry each set of wheels. The two troughs were connected to each other at both ends with a substantial tow bar for lifting the foundation separately, or the foundation and the generator unit. The bearing surface of both troughs is adequate to support the generator unit if the location is staked out on shifting sands, or when rains make mud holes on gumbo or clay.



Lubrication of Wells Simplified

An overhead tightwire above a group of closely-spaced wells, will enable pumpers to make periodic temperature and pressure measurements where a lubricator is required. Here are six wells located on eight-foot centers placed on an offshore platform. Because of high pressures involved, all instruments, such as pressure and temperature bombs, as well as paraffine knives, had to be lubricated into the tubing string.

The 2½-inch lubricator, when fully assembled, represented considerable weight, and was difficult to connect when preparing to run instruments in the well. By stretching a tightwire across all wells, a pipe ladder as shown can be secured to the wire enabling the pumper to stab the lubricator onto the well head.

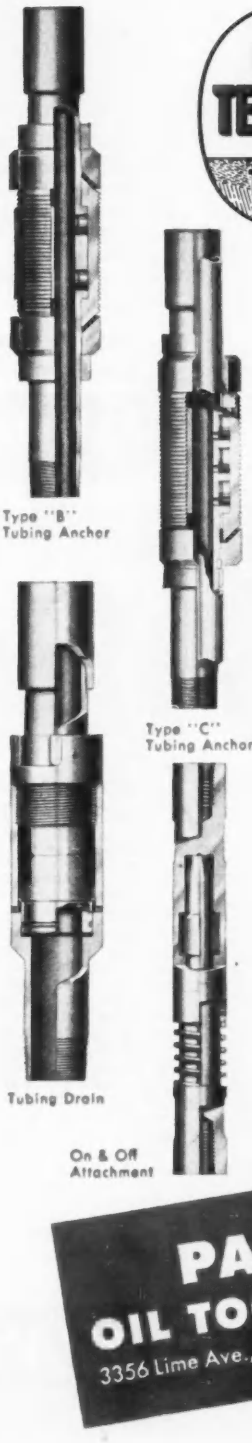
In case a long tool is run in the well, such as several sections of paraffin knives, additional pieces of lubricator can be added conveniently. An additional advantage offered by the tightwire is that the lubricator may be braced against lateral movements.

Two vertical pieces of four or five-inch pipe are welded and braced to the platform deck and a ¾-inch wire line tightly stretched between them. Eyes welded to the deck serve to anchor the wire line at each post. Should a well need to be worked over, there is no problem in removing the tightwire.

Partitioned Tank Is Storage Locker

At the warehouse, repair shop or at a central point in the field, a partitioned steel tank can do much to simplify the problem of storing and dispensing lubricants, solvents, etc. Here is an example of such a container, mounted at convenient height on a supporting pipe framework.

Measuring about ten feet long and four feet wide, this sheet steel tank was partitioned into four separate compartments, each unit designed to contain different liquids for use around the field. Discharge piping from each compartment terminates at one end where small globe valves con-



PAGE TENSION TOOLS

PAGE

TENSION TYPE

PRODUCTION TOOLS

at your

D + B and CONTINENTAL SUPPLY STORES

PAGE "TENSION TYPE" Production Tools—Tubing Anchors, Tubing Drains, and Sucker Rod On & Off Attachments—are available in the Mid-Continent through your nearest D+B and Continental Supply Stores. Check these new Tools. Get the *full* story on how *Page* Tools can cut production costs by keeping tubing in the hole longer!

PAGE TOOLS ARE *different*

TYPE "B" ANCHOR for ROD PUMP STRINGS: Page Type "B" Tubing Anchors set hydrostatically as the well pumps up!

TYPE "C" ANCHOR for MAIN AND PARALLEL STRINGS: Page Type "C" Tubing Anchors embody the same operation advantages as the Type "B" *plus* a special design for anchoring *both* main and parallel strings!

DRAIN AND BUMPER SUB COMBINED: Page Combination Tubing Drain and Bumper Sub affords a means of draining the tubing above the pump and can also be used as an effective up-jar!

ON & OFF ATTACHMENT for SUCKER RODS: Page's unique On & Off Attachment joins sucker rods to pump *after* tubing run-in—releases quick whenever desired!

FIELD RECORDS PROVE . . .

. . . that anchoring the Page Way *increases* pump efficiency and *decreases* equipment wear —visit your nearest D+B Pump Store or Continental Supply Store – find out how Page "Tension Type" Tools can help *you!*

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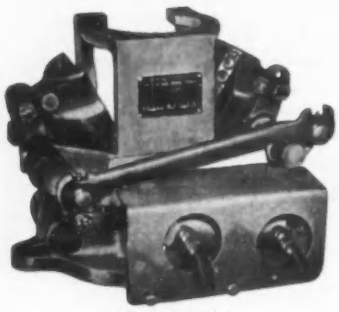
The Continental Supply Company Dallas, Texas

PAGE OIL TOOLS, Inc.

3356 Lime Ave., Long Beach 7, Calif.



(Pat. Pend.)

FIRST CHOICE among Production Men

(A Cavins Co. Product)

This is the original and only fully complete automatic AIR-POWERED TUBING SPIDER. Made in two sizes and will handle from 1¼" to 4¾" OD incl. single strings of tubing as well as all combinations of double and triple string installations.

No details have been overlooked to make it the finest tool of its kind. An ideal companion to your air powered tubing tongs, it will work for you from here on out. Full information promptly sent on request.

Advance Oil Tool Co.

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Export Rep. Roland E. Smith

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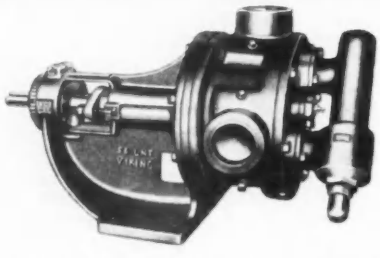
VIKING *Truck Mounting* **PUMPS**



The new improved Viking Truck Mounting Pump incorporates outstanding features: an improved bracket base with extra long packing chamber; a new style double supported valve on head; a revolvable type pump case which allows complete selection of ports. Available in units from 35 GPM to 300 GPM sizes. Write for literature.

Distributor

SOUTHERN ENGINE & PUMP COMPANY

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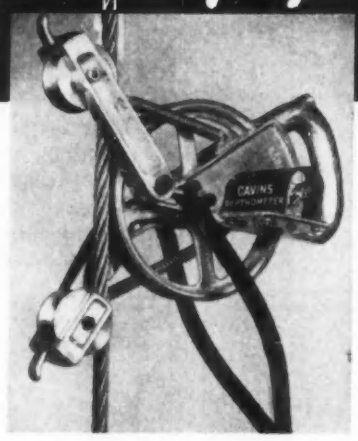
Why Guess ABOUT WIRE LINE MEASUREMENTS?



- Easy to Carry
- Direct Reading
- Quickly Put on Line
- Accurate Measurements

The Cavins DEPTHOMETER is a simple, compact direct-reading device that obsoletes "stringing-in" and gives you accurate measurements in very little more time than it takes to make a trip with your bailer. Comes in a handy carrying case (weighs only 17 pounds)—readily taken to any well—put on the line in a few seconds—priced to pay for itself quickly.—Write for illustrated folder.

THE CAVINS COMPANY

Main Office and Factory

2853 Cherry Ave., Long Beach 6, California, Phone 4-8564

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CAVINS DEPTHOMETER

FOR **SWABBING**

AUTO-RELEASE WIRE LINE STRIPPER

Finest in the field. King Strippers represent outstanding advances in design and construction that assure long life and maximum operating efficiency:

- POSITIVE LATCH will not release by accident or surge of pressure.
- SURE RELEASE MECHANISM operated by rope socket striking bottom of the stripper.
- NON-SPARKING MATERIALS minimize fire hazard.
- ROLLER WIRE LINE GUIDES on hardened steel pins.
- SIDE OPENINGS for inserting packing while line is in the hole.
- PACKING IS SELF-CENTERING; compression screws need not be evenly adjusted.

Export: R. S. STOKVIS & SONS
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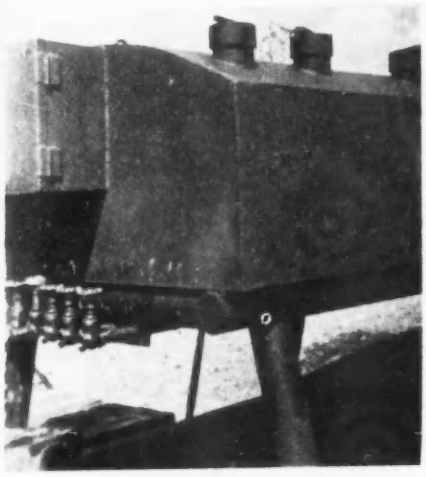
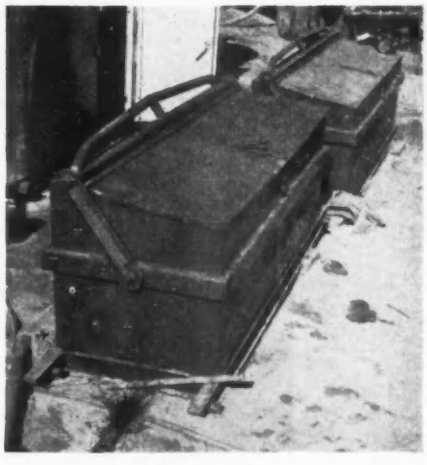
KING OIL TOOLS

210 TERMINAL ST. HOUSTON 20, TEXAS OSage 3-3421



trol the flow from each unit. By so identifying the control valve, the pumper, warehouseman or operator, can easily drain out that product he desires.

A metal cabinet equipped with a hinged door was welded to one end of the tank to serve as a handy storage for rags. The entire unit is portable, including the supporting framework which is detached from the tank. This assembly eliminates separate storage facilities for gasoline, different lubricants and solvents used in field operations.



Winch Lifts Box With Bail Handle

Loading and unloading the heavily-loaded tool box can be simplified to a great extent by a sturdy bail which will permit easy, direct lifting by a boom-equipped winch truck.

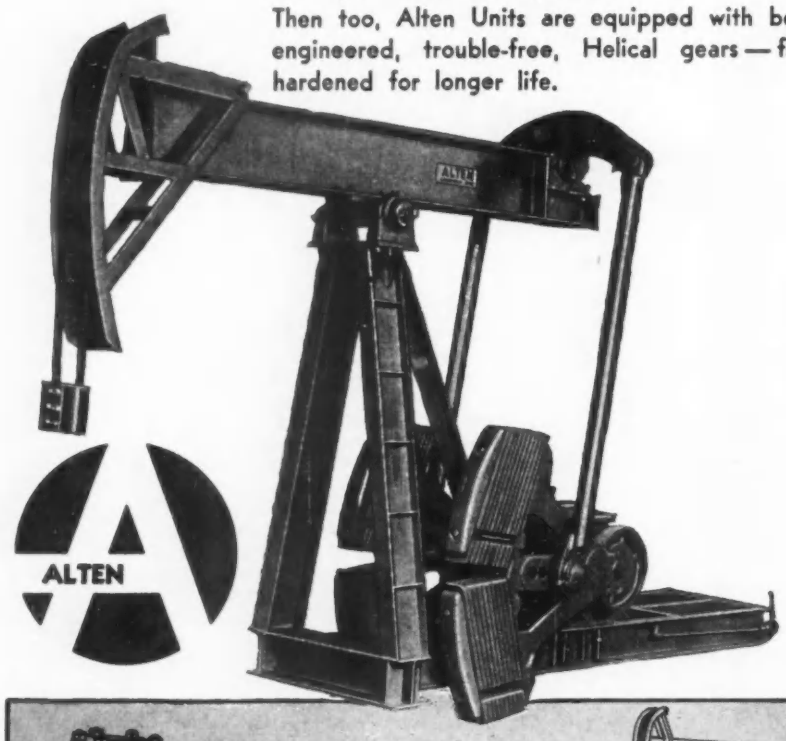
One operator equips his tool boxes with a bail that not only is sturdy, but is so designed that it can be swung back to the back of the box where it

for sand · abrasion · high temperatures
This all-around pump is particularly efficient in abrasive, sandy, or dirty fluids, and for wells with unusually high bottom-hole temperatures which cause unequal expansion of metal plungers and barrel tubes with critical fits. The "fluid seal" principle in the design offers a number of advantages over conventional rod pumps: The free-falling plunger and small bore subject the rods to less stretch and strain, and allow pumping at a greater strokes-per-minute rate; plunger friction and wear of working parts are negligible. The valves are fitted with standard A.P.I. size balls and seats; no special sizes are needed. A no-go ring on the standing valve seals off the seating area above the hold-down—an important feature for sandy wells. 12', 15', 18', and 25' pumps in 2"x1¼" and 2½"x1¾" sizes are available from leading stores throughout the oil country. Illustrated literature on request. Harbison - Fischer Mfg. Co., 2501 Virginia St., Box 64, Ft. Worth, Tex.
H-F
3
TUBE
ROD PUMP
HARBISON-FISCHER MFG. CO. — "Best Pumps in the Oil Patch"

ALTEN pre-testing means much to you

More fluid . . . uninterrupted operation . . . lower maintenance costs. You get them all with Alten Pumpers because each must prove itself in severe factory tests before shipment.

Then too, Alten Units are equipped with better engineered, trouble-free, Helical gears — flame hardened for longer life.



YOU GET THESE ADVANTAGES WITH ALTEN HELICAL GEARS:

EXTREMELY ACCURATE GEAR TEETH
Continuous direction of hob results in cutting accuracy beyond that obtainable from the shaper process which produces herringbone gears.

REDUCED SHOCK LOAD
Impact or backlash loads are 10 to 20% lower than those on herringbone gears because Helix angles are 50% lower.

MAINTAIN PERFECT TOOTH PROFILE
Because Helical Gears have no unflexing centers, stress is evenly distributed over entire face of gear teeth. Tooth profiles are permanently retained.

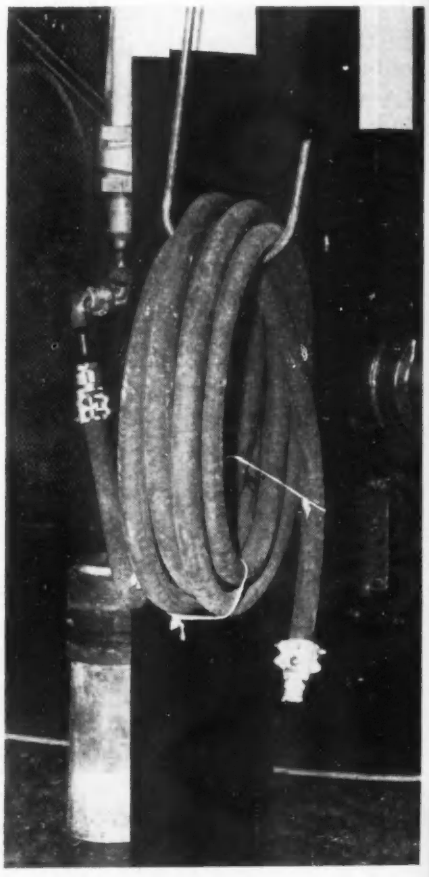
FLAME HARDENED TEETH
Gears are precision cut from finest alloy steel and shaved for perfect profile then flame hardened for highest surface hardness obtainable.

ALTEN
Foundry & Machine Works, Inc.
LANCASTER, OHIO

will not affect the normal raising of the tool box lid.

The side brackets of the bail are torch-cut of half-inch steel plate and further reinforced with angle iron welded along their lengths. The horizontal member spanning the length of the box is made up of two-inch pipe welded together to form a truss section which will not bend when the fully-loaded unit is picked up by the winch line.

Of interest in the construction of the box is the unusually strong piano-type hinge which runs the full length of the cover and which is not easily damaged by rough handling in the field.



Joint Reduces Hose Kinking

A swivel joint will eliminate hose kinking and base fabric rupture when attached between the hose and piping connections. There is a constant danger that a kink will develop when the hose is being hung on a hook. A twist in the clean-up hose ultimately

got

Free Piston

Pat. No.
2589332
2555112
ters pending

ANOTHER ADVANCEMENT IN THE FIELD OF ARTIFICIAL LIFT

Three years of extensive field tests have *proved* the GOT Pressure Charged Free Piston, and it is now available for use in your wells. During the long development period, when it was used in numerous wells of all depths and types, the Free Piston consistently reduced gas/fluid ratios, permitted lower injection gas pressures, kept the tubing strings clean and, in most instances, increased production. We invite you to get the full story on this efficient new production tool. Ask your GOT representative or write for our Free Piston bulletin.

BELLOWS

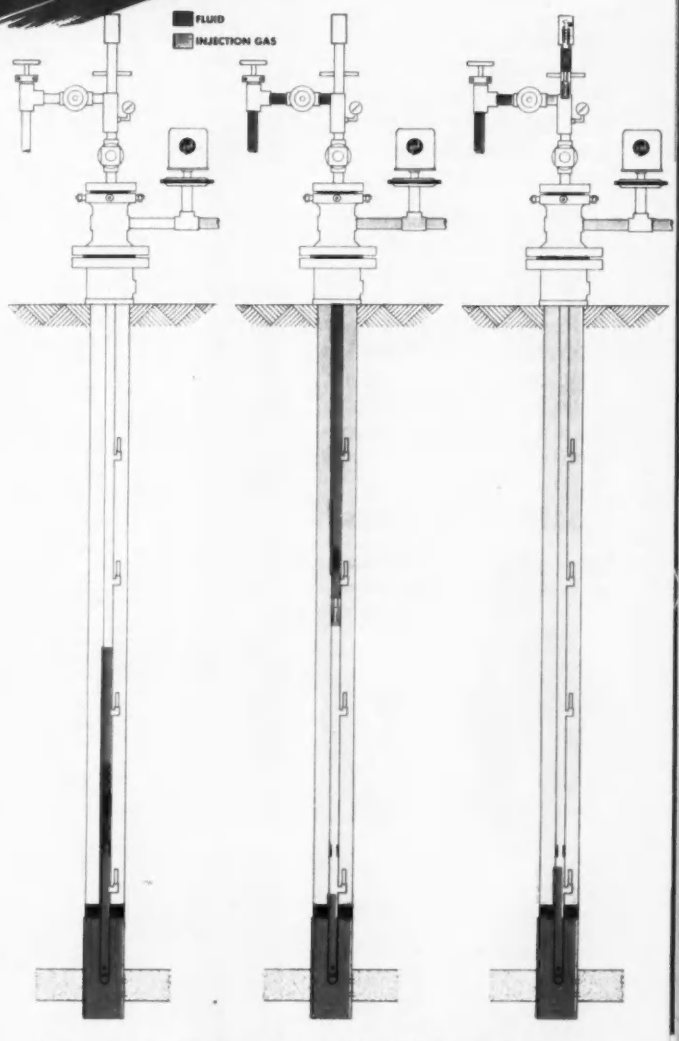
PACKER

BURRING TOOL

Pressure charged bellows insures proper operation in different types of wells.

Rubber packer is extremely resilient, seals positively and gives exceptionally long service.

Burring tool, interchangeable with the packer, conditions your tubing by removing burrs, scale, etc.



Working in conjunction with GOT Gas Lift Valves, the Free Piston is entirely automatic. When a predetermined head of fluid is above it, the rubber packer seals off inside the tubing. Gas is then injected through the operating gas lift valve, driving the Free Piston and the fluid to the surface. After the gas lift valve closes, tubing pressure bleeds down and the Free Piston returns to its "stop."

"IMPROVES EFFICIENCY . . . REMOVES PARAFFIN"

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Are You Pumping . . . When You Could Be Gas Lifting?

Garrett Oil Tools, Inc.

P. O. BOX 6115 HOUSTON 6, TEXAS

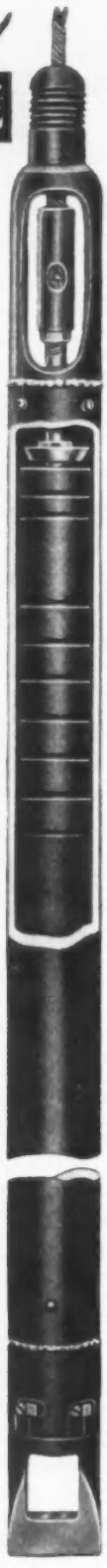
Manufacturers and distributors of
the world's most complete line of gas lift valves

Miller SAND PUMPS

INCREASE PRODUCTION

Where sand or sediment is a problem you will find Miller Sand Pumps are the standard clean-out tool. For 28 years Miller has held this leadership with continuous improvements and faithful service.

Miller Sand Pumps are made in regular and heavy duty types with lug type sand, chisel and bailer bottoms which are easily interchangeable. Threaded type bottoms that do not have to be removed to dump sand pump are available.



Chisel Bottom Illustrated

SAND PUMP SIZES

Outside Diameter

2½"
3"
3½"
4¼"
5"
5½"
7"

Lengths

20 feet
25 feet
30 feet

Special Sizes and Lengths Made to Order!

Write for descriptive price list on Miller Sand Pumps and regular and sectional bailers. See Composite Catalog Page 3365 for details.

MILLER SAND PUMP CO.

1524 S. E. 29th St.....Box 4516

OKLAHOMA CITY 9, OKLAHOMA

Export Office
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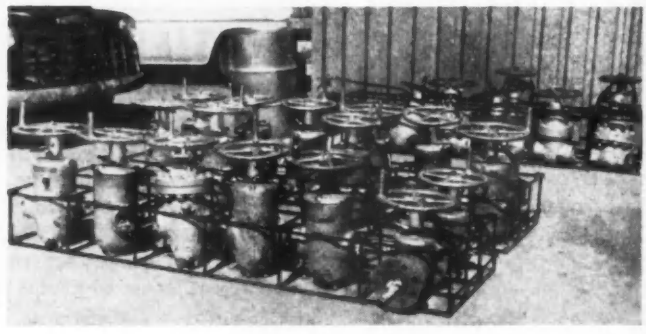
New York 20, New York

reaches the pipe hose junction point and, unless there is a swiveling device, the twist will likely damage some component of the hose structure.

Permitting a swivel action in all directions, this simple, inexpensive device will soon pay out with a noticeable saving in hose maintenance.

Frame Is Safe Valve Storage

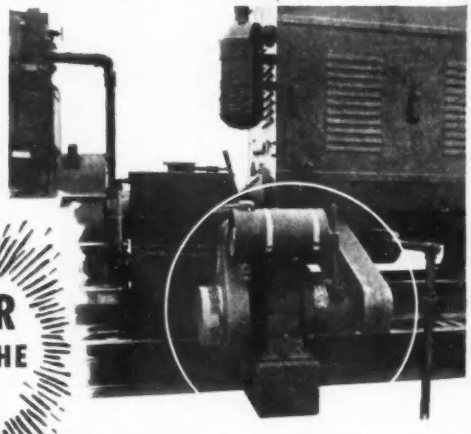
Reconditioned or uncrated high-pressure, heavy-duty valves can be stored efficiently and safely in a box-like framework made of salvaged sucker rods. Not only does this method save valuable storage space, but it is neat and orderly, making the jobof checking valves an easy one.



These valve storage racks are about 10 feet long, 3½ feet wide and 12 inches high. They can be made in sizes to accommodate several valve sizes. The frames are all welded, and sectionalized, allowing a space of about 20 x 18 inches for each valve. They are intended to be placed on the ground, warehouse floor or hard-surfaced storage area. If the valves are protected from the weather, they may be stored outside.

Here are three such storage racks, all filled with various types of valves, both welded and flanged. The racks not only support the valves in an upright position, but prevent the valves from falling over when accidentally bumped. Heavy valves such as these can injure a person's foot should one accidentally fall upon it. Although

ONE DAY'S OIL SAVING Pays for This WISCONSIN-Powered Starter



POWER TO FIT THE MACHINE — POWER TO FIT THE JOB

The Wisconsin Air-Cooled Engine was chosen for this type of specialized service because of its dependability, the simplicity of design, heavy-duty service features, the easy access of operating adjustments and its weather-proof characteristics. An interesting accessory included in the starting unit here shown, is the heavy-duty, totally enclosed, positive action (at all speeds) Twin Disc Clutch . . . designed to prevent possible injury to workmen and providing complete protection against sand and dirt. This prevents wear to which outside yoke types are ordinarily subjected.

WISCONSIN MOTOR Corporation
MILWAUKEE 46, WISCONSIN
World's Largest Builders of Heavy-Duty Air-Cooled Engines

WRITE TO HARLEY SALES CO.
619 S. MAIN STREET, TULSA, OKLAHOMA
M & M BUILDING, HOUSTON, TEXAS
505 SOUTH MAIN ST., WICHITA, KANSAS
OIL FIELD DISTRIBUTORS FOR WISCONSIN ENGINES AND ALL TYPES OF UTILITY UNITS.

The finest in AUTOMATIC Pressure Control for modern drilling!

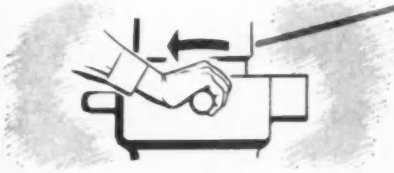
THE SHAFFER COMBINATION ROTATING BLOWOUT PREVENTER AND STRIPPER

...stands alone in the pressure control field because nothing else approaches its wide-range versatility—its unique simplicity—*or its positive dependability!*

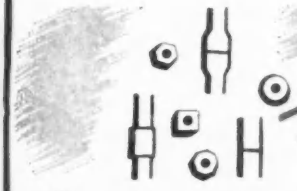
With this unit there's nothing to operate—nothing to remember—nothing to forget. It *automatically* seals off around the drill string as soon as the tools are lowered into the well—*and maintains—without attention—its pressure-tight seal throughout all subsequent drilling and pipe-changing operations.* It is always ready for any pressure emergency that may occur, whether drilling or while running pipe in or out of the well!

Here, step-by-step, you can see how the Shaffer Combination Rotating Blowout Preventer and Stripper gives positive protection during every phase of modern drilling procedures...

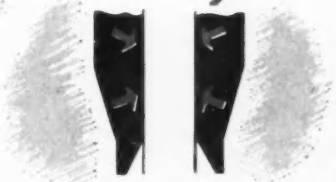
1 **NOTE THE COMPACTNESS** of the entire unit, reducing height and width requirements to a minimum and permitting installation even under difficult space limitations. Even the flow connections are incorporated into the body, eliminating need for spools or other extra equipment.



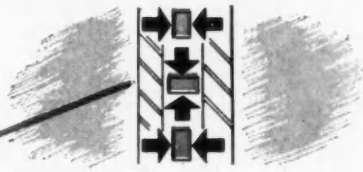
2 **CHECK THE SIMPLICITY** with which the bit and reamers are passed through the unit into the well. Simply lower the tools into the well, seat the rotating assembly in the body and rotate the bonnet 1/6 turn. The entire internal mechanism is then locked into operating position and sealed against any pressure until the tools are again removed from the well.



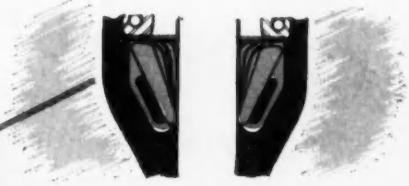
3 **THE VARYING DIAMETERS** in the drill string—drill collars, subs, couplings, tool joints and drill pipe (whether upset, flush, or coupled)—all pass readily through the unit without losing the pressure-tight seal because the Stripper Rubber *automatically* expands and contracts to pass them. Even the kelly—whether square, hexagonal or octagonal—is fully sealed by the Stripper Rubber *without manual adjustments of any kind!*



4 **PROTECTION AGAINST PRESSURE IS CONTINUOUS**—not only while running the varying shapes and diameters of the drill string into the well—but also throughout all rotating operations, whether forward or reverse. No mechanical or hydraulic pressure of any kind need be applied from the outside—nor are any adjustments necessary in the unit to maintain the seal during the various operations of drilling or of going into or coming out of the well.



5 **FREE ROTATION** during all drilling operations is assured because the Stripper Rubber rotates *with* the kelly—not one inside the other. Therefore, wear on the Stripper Rubber is negligible, reducing maintenance and assuring a pressure-tight seal. In addition, separate thrust and radial bearings are used to withstand any combination of loads due to high pressures and high-speed drilling. All bearings are lifetime pre-packed with heat-resisting lubricant!



6 **THE SEAL IS MAINTAINED**, also, while the drill string is pulled out of the well because a patented barrier of flexible steel latches permits pulling the larger diameters of couplings, tool joints and subs through the unit without damage to the Stripper Rubber. In addition, this expandable steel barrier prevents the rubber from extruding under high well pressures.

Get full details on the Shaffer Combination Rotating Blowout Preventer and Stripper from your nearest Shaffer representative—or write direct!

Send for your free copy of the new Shaffer catalog.

See pages 4525 to 4600 of your 1951 Composite Catalog!

29 years OF OIL TOOL LEADERSHIP

SHAFFER

HIGH PRESSURE DRILLING AND CONTROL EQUIPMENT • FISHING TOOLS THAT EXCEL

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On the drilling rig MARLOW pumps are the "spark-plugs" of the water supply:

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- FOR PUMPING WATER TO AND FROM SLUSH PIT
- FOR CLEARING OUT WASTE ACCUMULATION UNDER DERRICK FLOOR
- FOR DRINKING WATER SUPPLY
- AND FOR GEOPHYSICAL, PRODUCTION AND PIPELINE OPERATIONS.

MARLOW *pumps* "do a job"

MARLOW pumps combine the long-range efficiency of centrifugal pumping with positive self-purging action.

MARLOWS are preferred because they are efficient, dependable and durable. They are job-engineered for faster priming—at higher suction lifts—and to handle more water at easier engine speeds.

The trend continues to MARLOW . . . because after many, many months of service they are the only pumps that can be made to perform like new by simply replacing impellor and diffuser. Maintenance is low . . . efficiency high. Marlow pumps are built for long, hard use. (Sizes 1½ to 10". Engine or electric motor driven.)

Also available are Marlow Mud Hog pumps for handling quantities of sludge and wastes.

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MARLOW PUMPS
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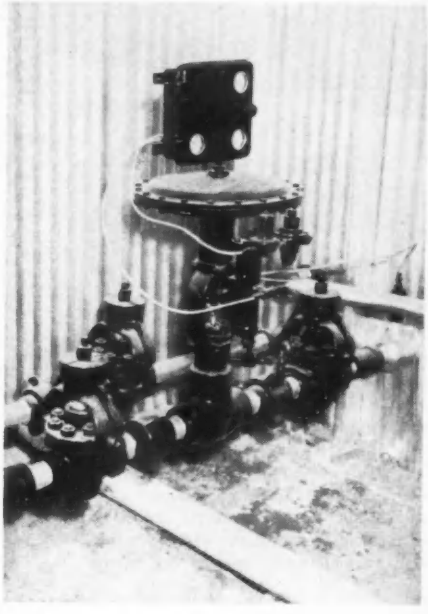
many valves are made with webs that hold them upright, other valves, and especially those with flanges, are difficult to keep upright in storage.

It is an easy matter for the clerk to make a quick check of valves in stock for inventory purposes, and the selection of valves for field installation is made easy.



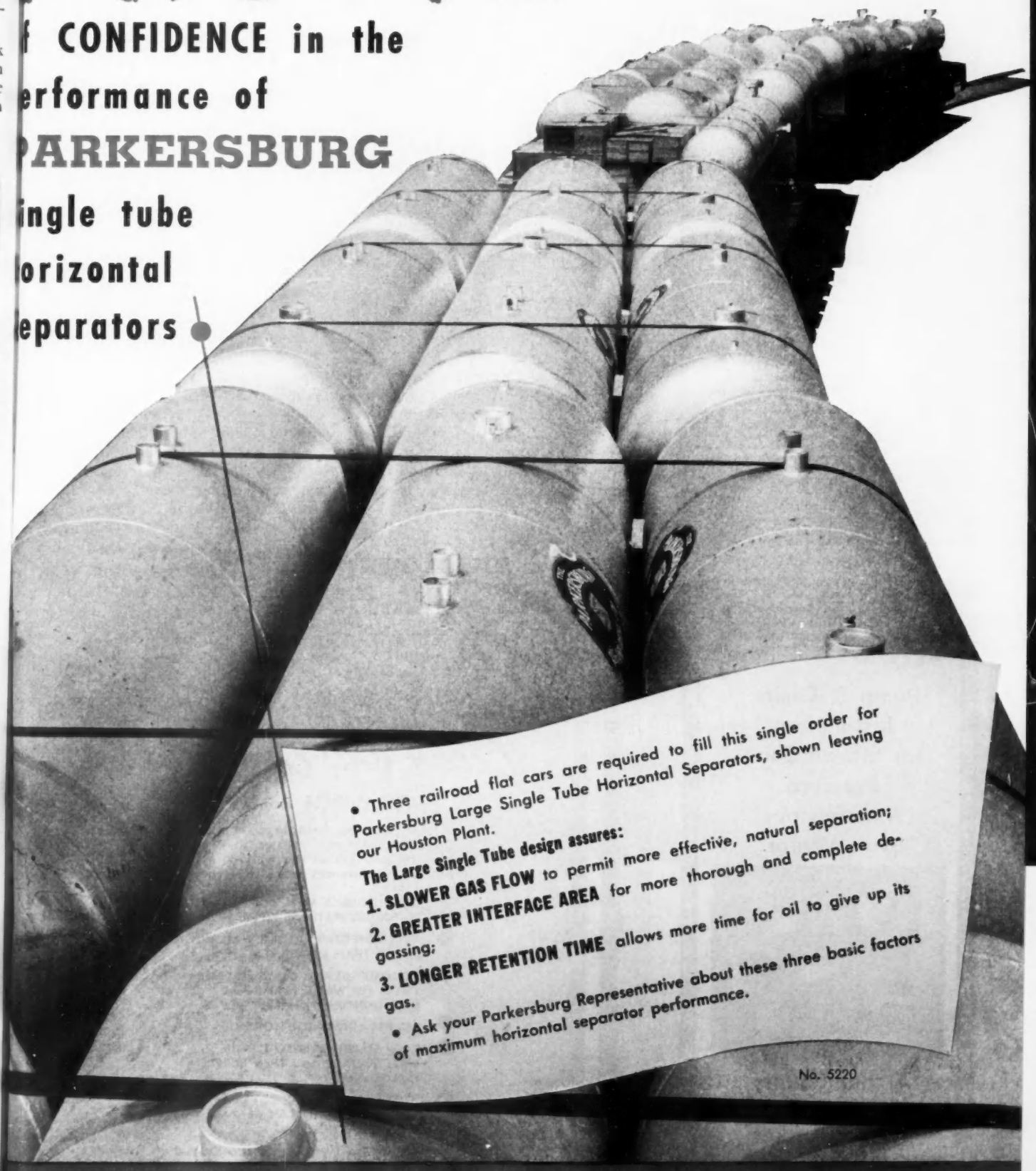
Heater Prevents Regulator Freeze

When reducing gas pressure down to working levels, it was found that during the winter months, the pressure regulator would tend to freeze due to hydrate formation. It was not a severe problem and one that was solved with just a few degrees of heat. In order to simplify the problem and eliminate a costly hookup, a small corrugated metal shed was built around the regulator and associated equipment.

A four-inch pipe was laid on the ground below the regulator to act as a heater for the small shed. A gas jet was placed at one end of the four-inch line that extended completely through the shed. The fire entered one end of the pipe and was exhausted at the other, to keep the fire hazard at a minimum. During the winter, sufficient heat was generated inside the shed by the simple heater to prevent the formation of hydrates in the regulator and it has operated satisfactorily for several seasons.

PROOF...

f CONFIDENCE in the erformance of PARKERSBURG ingle tube orizontal eparators



• Three railroad flat cars are required to fill this single order for Parkersburg Large Single Tube Horizontal Separators, shown leaving our Houston Plant.

The Large Single Tube design assures:

1. SLOWER GAS FLOW to permit more effective, natural separation;

2. GREATER INTERFACE AREA for more thorough and complete degassing;

3. LONGER RETENTION TIME allows more time for oil to give up its gas.

• Ask your Parkersburg Representative about these three basic factors of maximum horizontal separator performance.

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PARKERSBURG

PRESSURE EQUIPMENT

HORIZONTAL AND VERTICAL SEPARATORS • HYRECO • HYDRACEPTER • SCRUBBERS • TREATERS • HEATERS

Manufactured in Houston, Texas

Be sure the connections
ARE LEAK PROOF!

Make them up with
RECTORSEAL!

• You'll never have to worry about connection leaks on Fuel, Water and Air Lines; Tubing and Casing connections when you make them up with RECTORSEAL. Apply Rectorseal directly from the container. It sets-up quickly to a plastic elasticity that positively seals the connection . . . and keeps it sealed until broken-out.

Ask for Rectorseal by name at your Supply Store. If they can't supply you, write RECTORSEAL, Dept. G
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RECTOR WELL EQUIPMENT CO., INC.
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MAKING THE OIL INDUSTRY SAFER

SECONDARY MODERN RECOVERY
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PRODUCTION ENGINEERING
SERVICE, INCLUDING
CORE ANALYSIS

PRESSURE MAINTENANCE WITH GAS OR WATER

Pump & Engine Installation for Strawn Sand Pressure Maintenance with Water

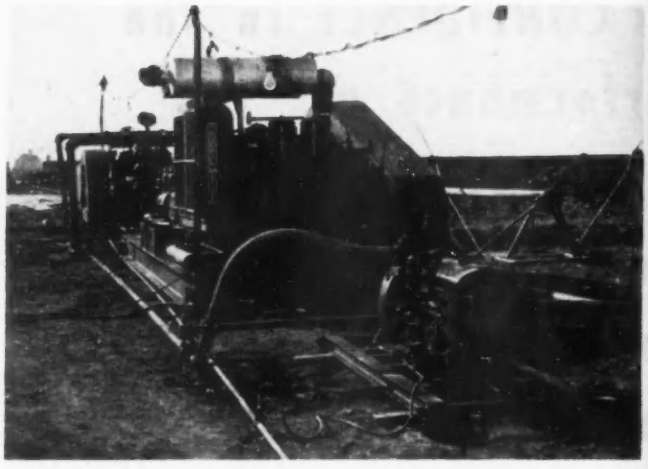
Archer County, Texas

REPRESSURING WITH GAS OR WATER

SURVEYS
ESTIMATES
DESIGN
INSTALLATION
SUPERVISION

PETROLEUM ENGINEERS
CABLE ENGINEERING
WICHITA FALLS, TEXAS

Utility Pump Charges Suction



Workover rig operation often finds the mud pump working at a disadvantage due to temporary pit lay-out and inadequate water systems. For this reason, one contractor connected an auxiliary pump to the mud pump system so as to deliver either mud or water to the pump suction.

When this practice is used, pit locations or water supply do not present a serious problem since it is possible to deliver pressurized mud or water to the mud pump suctions. In case two mud pumps are in use, installation of a simple manifold will make it possible to charge the suctions on one or both pumps.

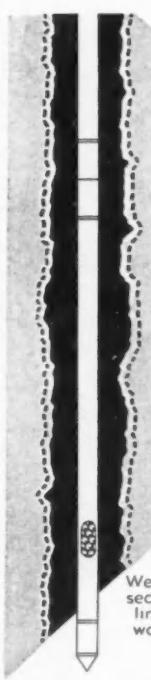
Wood Box Stops Sand Movement

When back-pressure regulators placed in separator flare lines are extended just above the ground in the West Texas plains, provision must be made to prevent them from being covered during sand storms. To make a neat installation at the tank battery, all lines are normally buried just below the ground level during installation. Where counter-weights are used on back-pressure valves, the upper part of the valve body must be above ground to permit proper functioning of the valve. In many fields in the West Texas and New Mexico area, unless the valve is adequately protected, sand will build

Clean Out Congested Wells
WITH BURCH AGATE TORPEDOES

Marble blasting pays because marble abrasion is thousands of times greater than sand blasting. It frees oil and gas in the well bore by removing all retarding substances from the true pay formation.

- CONDITIONS A WELL BORE OR SHOT HOLE BY RESTORING NATURAL FORMATION.
- ABRASION REAMING THE WALL CONTOUR DEEPER THAN RETARDMENT.
- EXPLOSIVE-DRIVEN GLASS MARBLES STRIKE THE WALLS WHOLE AND IN A UNIFORM PATTERN.
- 242 PER LINEAL FOOT OF HOLE.
- EACH MARBLE PENETRATES THE WALL SURFACE AND THEN BURSTS EXPLOSIVELY.
- DESIRED COLUMN TO COVER PAY IN ONE RUNNING CAN BE MADE WITH 5' SECTIONS.



Well bore cross section. Dotted lines indicate wall reaming.

Cross section view of torpedo

SIMPLE • IMMEDIATE • ECONOMICAL

BURCH Agate Torpedo

CALL YOUR OWN SHOOTER

BORGER, TEXAS

Built Up..

to Oil Field Standards!

Fairbanks-Morse 8-Cover Side-Pot Duplex Power Pumps are built *UP* to the rugged design and conservative standards of oil field pump practice . . . built *UP* to last . . . built *UP* to liberal strength and safety factors.

They are not built down to achieve lighter weight with consequent sacrifice in design, materials and dependability. Light weight in an oil field power pump is a dubious advantage at best. Strength and service are the important considerations.

When you want dependable, efficient, long-life, low-cost service, your choice should be Fairbanks-Morse, the power pumps that set performance and economy records wherever they are used. Fully bronze-fitted, oil-fitted, or slush-fitted styles, Fairbanks, Morse & Co., Chicago 5, Ill.

FAIRBANKS-MORSE,

a name worth remembering

OIL FIELD EQUIPMENT • PUMPS • SCALES
ELECTRIC MOTORS • GENERATORS • LIGHT PLANTS
DIESEL, DUAL FUEL AND GASOLINE ENGINES • MAGNETOS

REDA PUMPS

FIRST CHOICE for Secondary Recovery Water Flooding...

The lower the expense of producing source water from wells for water flooding operations, the greater the ultimate profit.

Reda Pumps for source water wells provide many ways for lowering these production costs.

Improved design and longer operating life *lower* the cost of labor per barrel, *lower* the cost of maintenance per barrel, *lower* the investment cost per barrel, *lower* the cost of fluid per barrel.

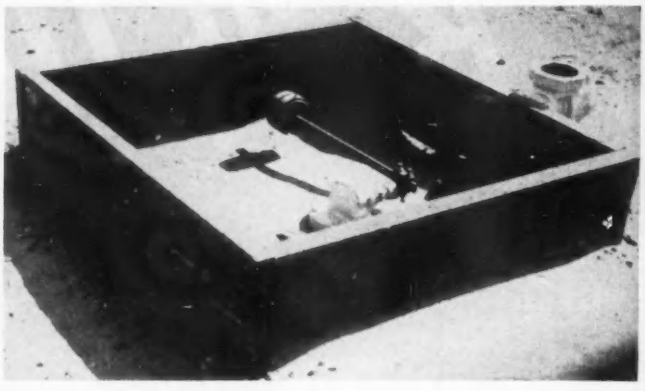
Also the ability of Reda pumps to produce greater volumes in limited casing sizes and from greater depths often reduces the number of source water wells required.

Reda engineers have long been associated with water flooding operations and are fully qualified to assist operators in discussing their source water requirements.

REDA

PUMP COMPANY

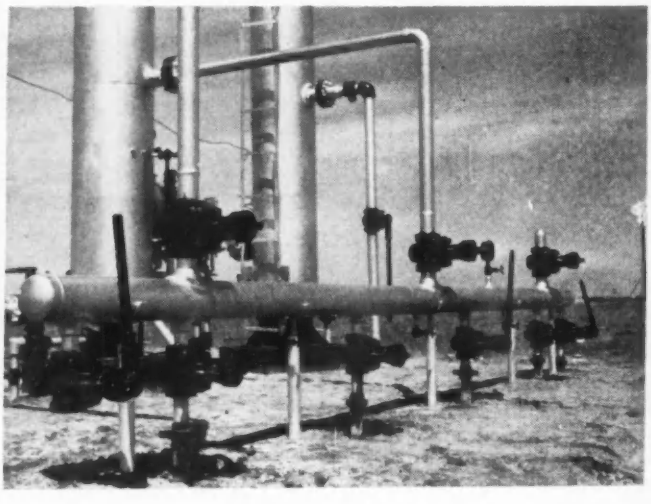
BARTLESVILLE, OKLA.



up over it and thereby prevent the valve from serving its purpose.

The most economical and simple method of preventing sand piling up around and under the back-pressure valve counter weight arm is a common timber box structure. Made of 2 x 12-inch material, the box measures about 5 x 5 feet, and merely rests on top of the ground surrounding the back-pressure valve. The heavy timber is necessary to prevent damage from cattle or trucks inadvertently backing into them. During sand storms or when daily winds keep sand moving just above the ground, these boxes prevent the sand from accumulating around the valve. The lighter dust blows over the box while the larger grains are piled up on the outside of the box.

Separator Manifold Helps Hookup



Where volumes produced are more than the efficient capacity of one separator, two units can be hooked up conveniently by employing an above-ground inlet manifold as shown. Not only are valves and connects in full view and easy to work on and fabricate, but the operation of all valves is simplified.

An eight-inch inlet manifold in this case was mounted on adjustable pipe stanchions about 30 inches above ground level. Lead lines from several wells can be connected into the manifold, and two or more outlets are provided. This high-pressure installation was constructed so that either or both separators could be used, and a provision was made to utilize a third separator when additional production in the field was developed. Construction of the manifold was simplified by elevating it above ground, for all connects were welded. And, too, care and operation of plug valves used was facilitated. It is no difficult task for the pumper to switch from one separator to another, or to cut in and out any well leading into the manifold. By so arranging the manifold, additions to it can easily be made. The installation is neat in appearance and efficient in operation.

Keep Informed

Use the Reader Service Post Cards on Pages 89-90

Up the rimrock goes the 30-inch pipe line that carries Permian Basin gas to California. This slope of solid rock was so sharp that all equipment had to winched into place. Pipe was lowered from top, joint at a time.

The El Paso Story

One of the most incredible pipe line feats of our time. More than 6000 miles across fertile fields, mountains and wastelands.

By C. L. PERKINS
Vice President, General Superintendent, El Paso Natural Gas Company

FROM 1946 THROUGH 1952, El Paso Natural Gas Company increased its deliveries of gas from 150,000,000 cubic feet per day to 1,200,000,000 cubic feet. Construction is now underway which, when completed, will increase deliveries to 1,600,000,000 cubic feet per day. Applications are pending for further expansion which, if granted, will further increase deliveries to a total of 2,000,000,000 cubic feet per day.

Here are the important features of this expansion program:

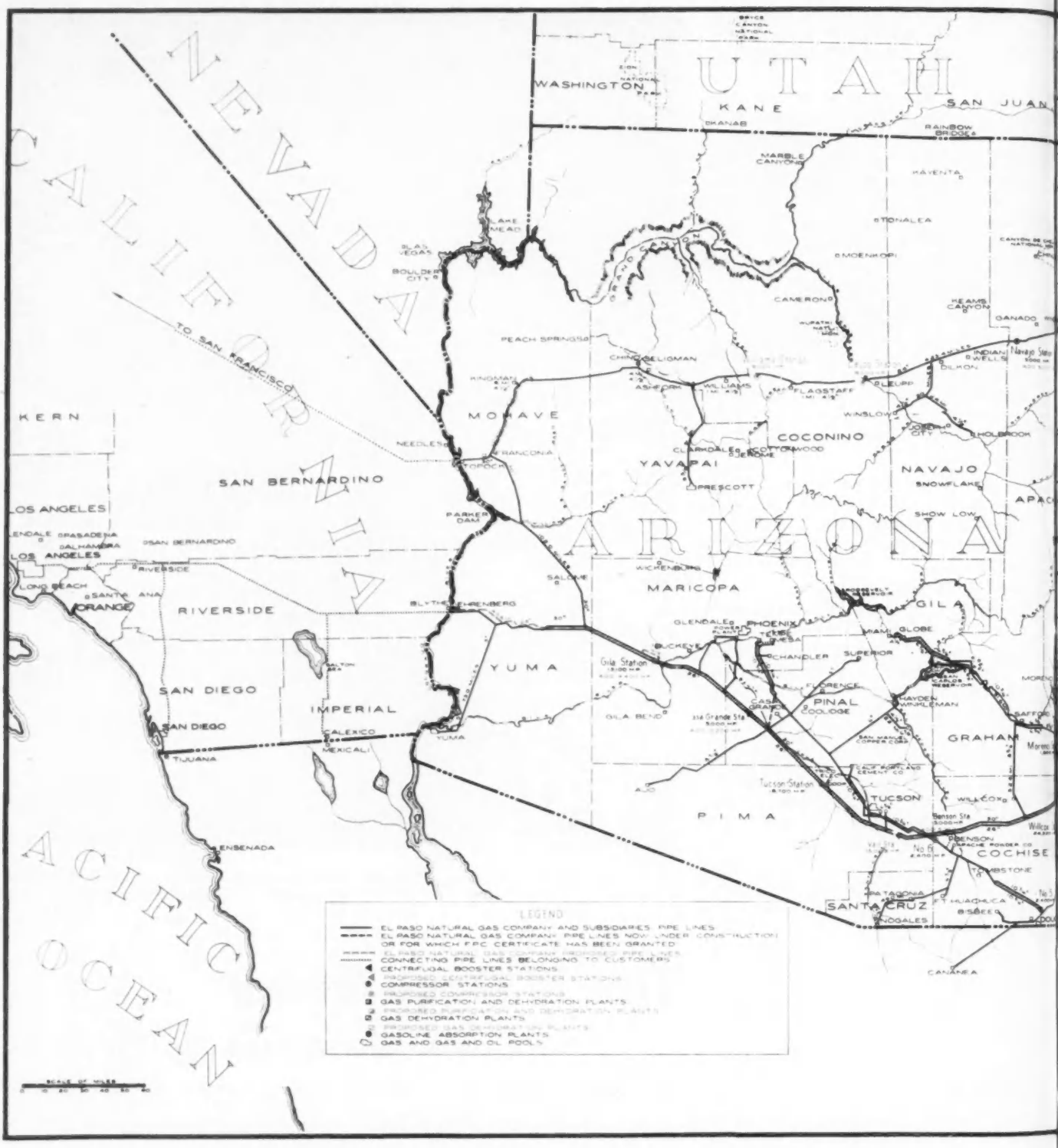
- The greatest part of the gas which the company delivers to market is residue-gas, a by-product of the production of oil and gasoline which, without the pipe lines to carry it to market, would necessarily be burned in flares at the field.
- The facilities which the company has built since 1946 have been planned, designed, and constructed almost entirely by personnel of the company itself rather than by outside contractors.
- The company operates through an area which is sparsely populated and the resulting isolation of pipe lines and pipe line facilities has forced the company to perform many tasks not usually connected with the construction and operation of pipe lines.

The expansion program into which El Paso Natural Gas Company entered in 1946 had two objectives: First of all, deliveries of gas were to be instituted to the state of California. Secondly, deliveries of gas to west Texas, New Mexico, Arizona and northern Mexico—the area which the company had served since the early 1930's—were to be vastly increased.

Although California had enjoyed natural gas service for many years, the state had experienced an unprecedented growth and development during the second World War. Population was up 60 percent as compared to a nationwide increase of 16 percent. New industries were moving in; established industries were producing more and more goods. At the same time, the gas reserves in California, upon which that state had drawn in pre-war years and during the war, were being rapidly depleted. Thus the state needed more gas because of its growth but the supplies available were less rather than greater than before.

El Paso Natural Gas Company and the distribution companies serving California reached an agreement for El Paso to carry gas to the Arizona-California border for delivery to the California companies which, in turn, carry that gas to the respective areas which they serve. Deliveries to Southern California Gas Company and Southern Counties Gas Company of California were begun in 1947 at a point near Blythe, Calif. Deliveries to Pacific Gas and Electric Company which serves northern California were instituted in 1950.

A great deal of attention has been paid to the expansion program as it affected California. The increase in service to the far southwest area served by the company since the 1930's has been, in itself quite significant. West Texas, New Mexico, Arizona and northern Mexico cities and industries receive today nearly three

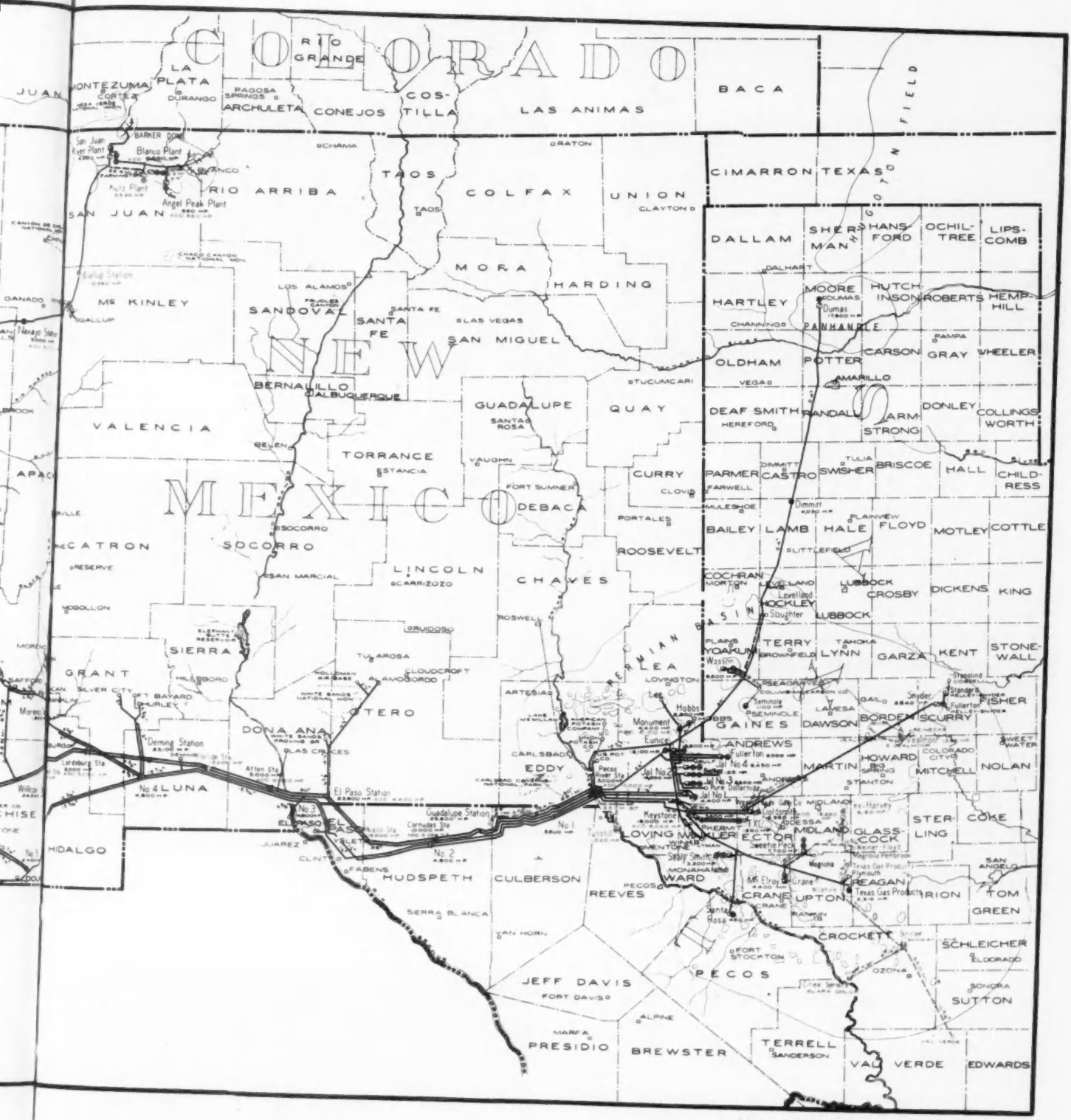


times as much gas as they did in 1945 so that, even without its expansion to California, El Paso Natural Gas Company would have accomplished a significant growth.

The first projects of the company in its postwar expansion were facilities dedicated to the transmission of gas out of the Permian Basin in southeastern New Mexico and west central Texas and the Hugoton field in the northern Texas Panhandle. A 26-inch line was put down in 1946-1947, and through this line, service to southern California was started.

Thirty-inch line, looping the 26-inch line, was started even before the 26-inch line itself was completed. In 1950, a 30-inch line, beginning at Quartzite, Arizona, and extending north to Topock, Ariz. was put down. This line, now known as the cross-over line because it connects the southern (Permian Basin) lines and the northern (San Juan Basin) lines of the company, made possible the institution of gas deliveries at Topock to Pacific Gas and Electric Company in 1950

The San Juan project of El Paso Natural Gas Company, consisting of about 450 miles of 24-inch mainline together with related gathering lines, field lines, treating facilities, and compressor power, was started in 1950 and put into full operation in 1951. Drawing gas from fields in the San Juan Basin of northwestern New Mexico and southwestern Colorado,



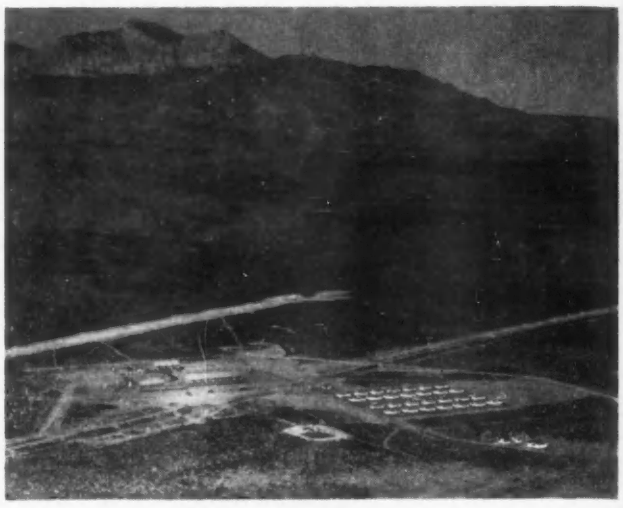
Map of El Paso Natural Gas Company system.

this pipe line system extends across northern New Mexico and northern Arizona to tie-in with the crossover line. Currently, it delivers 167,000,000 cubic feet of gas per day, 150,000,000 to Pacific Gas and Electric Company, the balance to northwestern New Mexico and northern Arizona.

In the Permian Basin, from which El Paso Natural Gas Company obtains most of the gas which it carries to market, natural gas is predominantly a by-product of the production of oil and gasoline. When oil comes up out of the ground, for example, natural gas bubbles out of that oil just as carbon dioxide bubbles out of soda pop when a bottle of that beverage is opened. At the same time the plants in the Permian Basin producing natural gasoline produce great quantities of natural gas as a by-product of their operations.

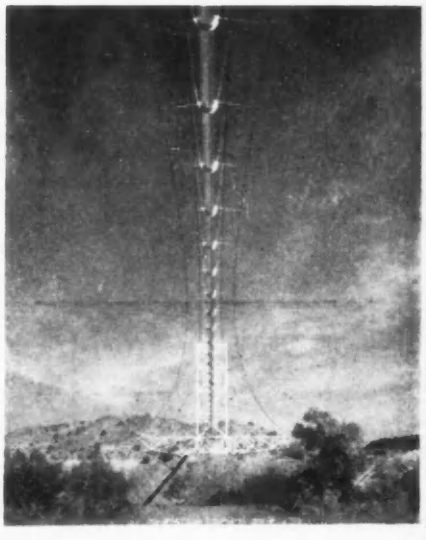
For years it was the practice to burn this gas in huge flares at the field. It was a total waste because there was nothing else to do with it. But El Paso Natural Gas Company began taking this otherwise waste product into its pipe lines and delivering it to useful purposes. Currently, about 70 percent of the company's deliveries of natural gas are made up of this residue-gas. Daily deliveries of residue-gas amount to more than 800,000,000 cubic feet. When facil-

Vast wastelands are crossed by El Paso Natural's lines. At times construction crews were more than 100 miles from nearest doctors. Safety-conscious crews held accidents to a minimum.

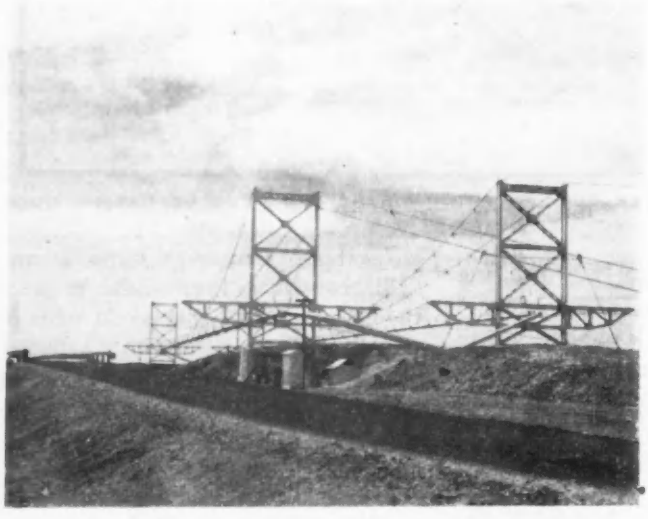


Guadalupe compressor station is 100 miles east of El Paso. Massive stone bluff in background is El Capitan, 8078 feet high. Road leading to station is part of El Paso's private system.

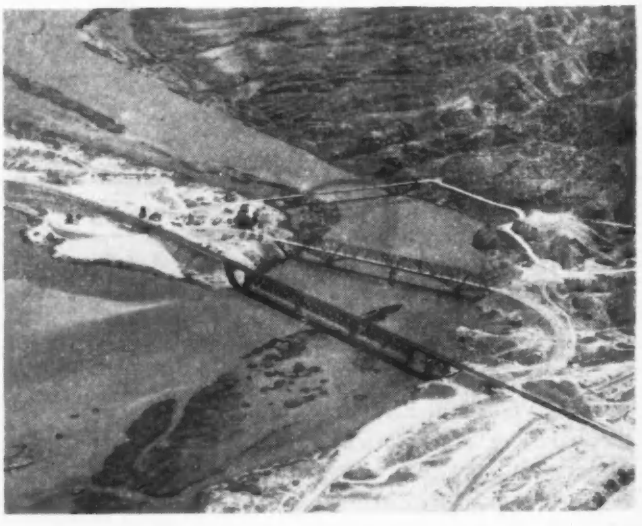
Here a crew is fording the San Juan river with glycol-amine still on the 137-mile haul from Gallup, N. M., to San Juan treating plant.



This bridge is a crossover line from southern lines to Topock, Ariz. It supports 30-inch pipe across 980-foot span over Bill Williams River.



Road bridge at left is part of El Paso Natural's private highway system. All three of these bridges across Pecos River in West Texas belong to the company.



Arizona at left and California at right. Upper bridge is pipe line crossing of Colorado River. This was once an old highway bridge.

ities now under construction are put into operation, utilization will rise to more than a billion cubic feet per day—more than 365,000,000,000 cubic feet per year. This volume of gas is equivalent, in fuel value, to 60,000,000 barrels of oil. The employes of El Paso Natural Gas Company take a great deal of pride in the fact that through the growth of their company a substantial contribution to the conservation of natural resources has been made.

It should probably be mentioned that the residue-gas utilization program poses some unusual operating problems. Because residue-gas is a by-product of the production of oil, the rate at which it is produced is determined by the market demand for oil and not by the need for gas. The rate of production of residue-gas is subject to tremendous fluctuations—seasonal, monthly, weekly, daily, and hourly—none of which are controllable by El Paso Natural Gas Company.

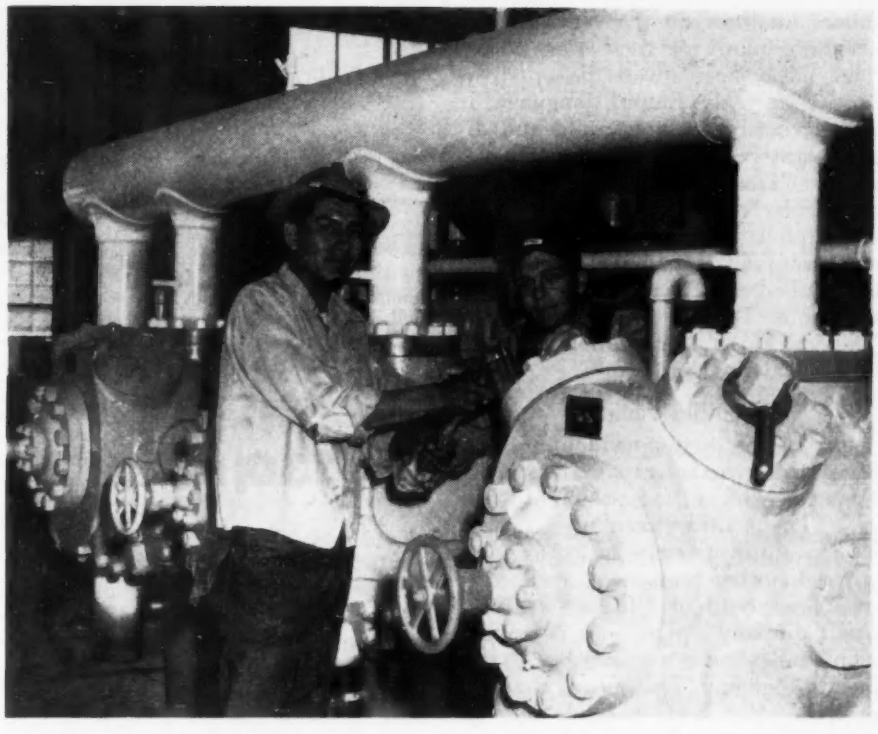
Oil is produced under monthly allowables in both Texas and New Mexico. When a well has achieved its production for the month, it is shut down. Thus, a great number of wells are shut down several days before the end of the month. In some months, practically all wells are closed off. This means that supplies of residue-gas are severely curtailed if not altogether shut off.

Or, again, sometimes the gasoline plant of an oil company will shut down for an overhaul. Sometimes it will stop operations suddenly because of a breakdown. Many plants of oil companies operate in daytime but not at night. When these plants stop operations, they quit delivering gas into the pipe lines of El Paso Natural Gas Company. A shutdown of only one plant will reduce deliveries into the lines of El Paso by as much as 50,000,000 or 100,000,00 cubic feet per day.

These shutdowns are made usually without any warning to personnel of El Paso Natural Gas Company. The first warning that the people of the company have that a shutdown has occurred is a drop in pressure in the location concerned.

The Permian Division of El Paso Natural Gas Company stretches about 375 miles from north to south and about 200 miles from east to west. Pressures from throughout this area are telephoned or telemetered in to the Dispatching Department of the Permian Division. The dispatchers quickly interpret a drop in pressure into terms of volumes of gas being cut off. They then radio instructions to switchers to turn on certain dry gas wells to fill in the gap between supplies of residue-gas and the need for gas. When a plant of an oil company comes back into operation after a shutdown—and this, too, is usually without any warning to personnel of El Paso Natural Gas Company—the dispatchers radio out to the switchers to turn off certain dry gas wells. It is believed that this constant adjustment of activities to the operations of many other companies is unique in the gas industry.

All of the facilities which have been put up by the company since 1946 have, with the exception of certain specialized items such as cooling towers, been planned, designed, and built by personnel of the company itself. Construction work has been handled by two departments, one for pipe line construction and the other for building construction.



Operators at Navajo Station. Half the personnel at this station in heart of Navajo Indian Reservation are Navajos. El Paso Natural had to teach many of them English as well as fundamentals of pipe line operations.

. . . . Indians turn pipeliners

Most of the men employed by the construction departments are classified as temporary employes since the completion of the expansion program would necessarily reduce the number of jobs. However, it has been the practice to absorb as many construction men as possible into operations work.

Men working with particular spreads or with a particular building construction crew have had the privilege of moving with that spread or crew to new locations. A number of men have been filling construction jobs with the company for more than six years.

Frequently, of course, construction personnel do not move on with a spread or crew. The vacancies which thus occur are filled as far as possible from communities close to the scene of construction.

One of the very interesting and highly satisfactory sources of construction personnel was the Navajo Indians living on their extensive reservation in northern Arizona and northwestern New Mexico. In 1950 and 1951, El Paso Natural Gas Company put down the San Juan mainline which extends for about 450 miles from San Juan County, New Mexico, across northern Arizona to a point near Topock on the Arizona-California border. About 250 miles of this pipe line and the Navajo Compressor station on that line lie wholly

within the Navajo Indian Reservation.

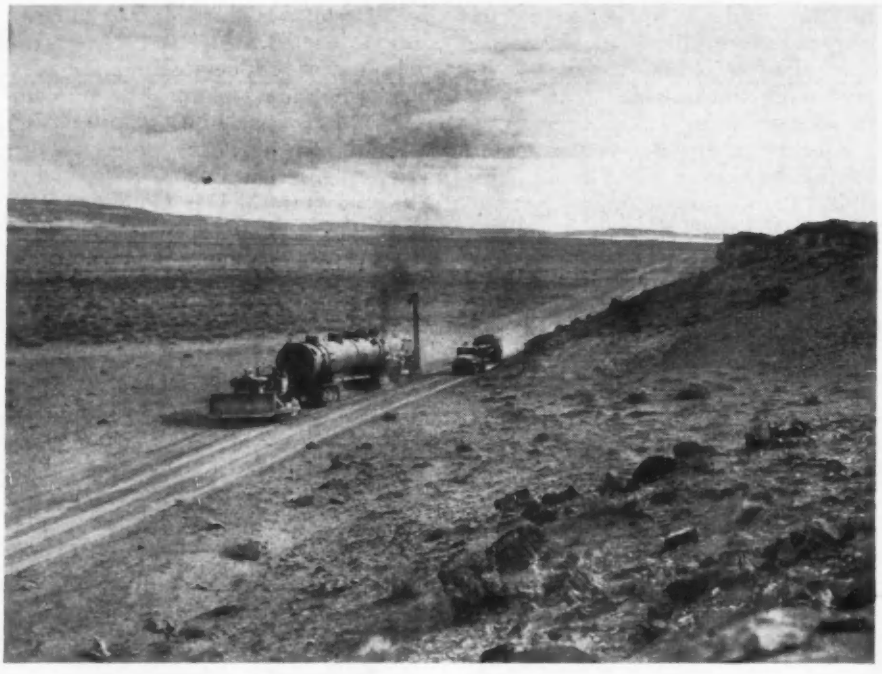
El Paso Natural Gas Company had to obtain right-of-way from the Navajo tribal council, the governing body of the Navajo people. Agreement was reached that, among other things, El Paso Natural Gas Company would employ as many Navajo Indians as possible in constructing facilities lying within the reservation and that operating jobs be given to Navajo Indians when the construction work was complete.

Because there is a shortage of school facilities on the Navajo Reservation, many of these fine people have never been given the opportunity to learn the English language. It was necessary to hire, train, and direct many Navajos by means of interpreters. The Navajo men proved to be extremely able working men. They were quick to learn, hard working, and ambitious. Many of them worked into skilled and semi-skilled job classifications. Today, half of the staff of Navajo Compressor Station is made up of Navajo men.

Facilities Isolated

One of the dominant factors in the company's construction and operations activities is the isolation of facilities. The southwestern area of the U. S. is quite sparsely settled as compared to other sections of the country. The route of El Paso Natural Gas Company's pipe lines is usually many miles from a railroad or even from a highway. This means that the company has had to haul most of the equipment and materials used in construction to location. Because of this need to supply its own transportation, El Paso Natural Gas Company has about 775 vehicles (counting both automobiles and trucks) in operation. These vehicles drive about 25,000,000 miles per year. About 350 of these vehicles, developing about 15,000,000 miles per year, are devoted to construction.

It has been necessary to build roads along most of the pipe line right-of-way. Access roads, connecting the pipe line road with highways, have been constructed at frequent intervals. Currently, El Paso Natural Gas Company owns and maintains more than 4500 miles of pipe line road. In addition, it maintains about 1500 miles of access roads which, however, are not owned by the company. With these roads, it is possible to drive all the way from Dumas, Texas, (the northern terminal of the Perminian Basin lines) to California without ever following a public highway.



Hauling ¼ million pounds 130 miles across rugged terrain of northwestern New Mexico from Gallup to San Juan Basin at three miles per hour. Three and sometimes four tractors were required to push and pull trailer with its cumbersome burden, a contactor for gas treating plant. Nine such vessels made this haul.

. . . 130 miles . . . push and pull

One of the most difficult hauling jobs was incurred in the construction of the San Juan River plant near Fruitland, N. M. The nearest mainline rail terminal is Gallup, N. M., which is about 130 miles away. The only railroad connecting Gallup with Fruitland is a narrow gauge line which just was not equipped to haul the heavy equipment and material involved.

Much of the material to build the San Juan plant was hauled by truck. Personnel of the Building Construction Department had to ready the highway for this hauling, however, curves were measured to be sure that none were too sharp for the long, heavy vessels that had to be carried around them. Occasionally, when a curve which was too sharp was discovered, a special road was built.

Bridges were checked along the highway between Gallup and Fruitland. Forty-eight bridges were shored-up to support the heavy weights. Others were by-passed by means of shoo-flies.

But even all of this work did not make it practicable to move everything by truck. There were nine vessels (contactors, stills etc.) weighing up to 185,000 pounds each which were too heavy to be carried along the highway at all. They would have crushed the pavement.

To haul these vessel to location, the men of El Paso Natural Gas Company put together a big track-laying trailer using the tracks from two worn-out tractors. The vessels were loaded onto the trailer and the whole load, weighing as much as a quarter of a million pounds, counting the weight of the trailer, was moved along the pipe line road by bulldozers.

At least three tractors were required at all times to keep the load moving. On hilly terrain, four were necessary—two pulling and two pushing. Hitched to their tremendous, cumbersome burden, the tractors moved at top speed of only a few miles per hour. The trailer, once started, was moved forward day and night. It required from two to three days to make the 130-mile trip.

Every 30 minutes, it was necessary to grease the tracks and bogie wheels of the tractors and the trailer. The men found that a mixture of graphite and white lead was the most efficient lubricant. More than 800 pounds of this mixture was used on each of the nine trips.

The isolation of the pipe lines and compressor stations posed difficult situations. For example, spreads fre-

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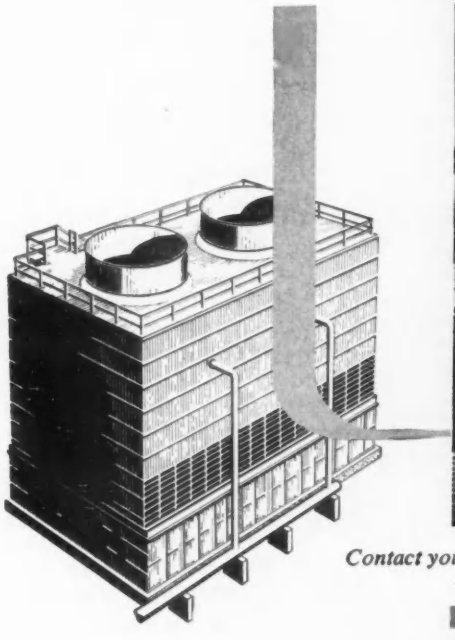
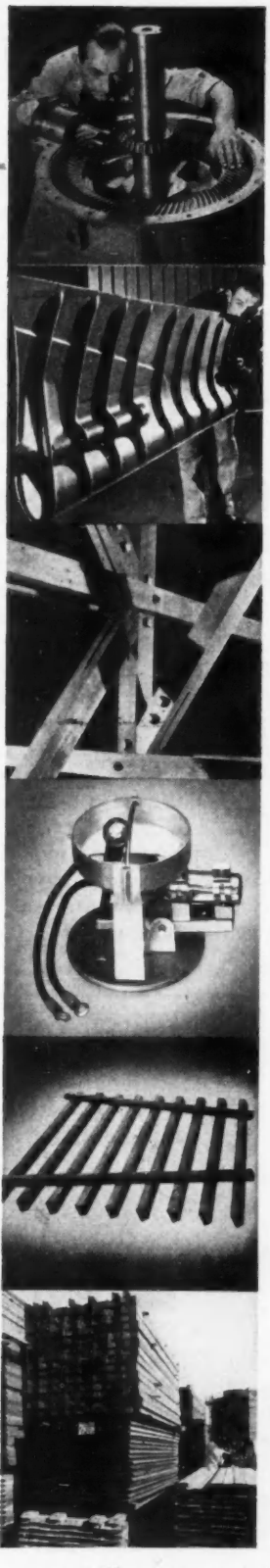
induced draft counterflo cooling towers provide these 6 exclusive features...





Spiral Bevel Gear Speed Reducers

Only Fluor-Western speed reducers incorporate curved tooth spiral bevel gears as standard design. This proven principle provides quieter, smoother, more efficient operation under the rugged conditions of cooling tower service. Other special design features include: oil-bath lubrication; dry air breather; chrome-plated shaft at oil seals; and, low-speed fan shaft mounted on special steep angle thrust and radial bearings to take combined gear thrust, fan thrust, and weight of fan assembly.

Unique Fan Blade Design

The Fluor Type HC Stainless Steel Fan blades, furnished as standard on every Fluor Counterflo Cooling Tower, are a joint development of The Fluor Corporation and Solar Aircraft Company. Designed specifically for induced draft cooling tower service, their unique air foil handles maximum air volumes at minimum tip speeds and horsepower requirements. Design *plus* mechanical arrangement eliminates recirculation of air and resulting power-consuming turbulence.

Internal Gusset Plate Construction

Fluor Counterflo Cooling Towers alone make full use of tensile as well as compressive strength of structural members! Their internal gusset plate design duplicates that used in wooden bridge construction. These simple, yet extremely strong joint connectors mean longer tower life, lower total tower weight, fewer and simpler castings, greater ease of erection, and minimum spoilage should the structure be dismantled, moved and re-erected.

Patented Vibration Cut-Out Switch

The Vibration Cut-Out Switch developed and patented by Fluor in 1944 protects tower structure and mechanical equipment by stopping the motor should excessive vibration suddenly occur. In addition to its value as an emergency safety device, the switch can be utilized by the operator as a positive "on-off" switch during routine inspection of tower structure and mechanical equipment. The motor cannot be started accidentally once the switch is placed in the "off" position.

Sloping-Bar Grid Decking

Exclusive Fluor-designed sloping-bar grid decks are of rough-finished 1" select redwood machine-nailed to 1" x 2" cleats—strong enough for use as scaffolding during erection, rugged enough to withstand the erosion of falling water. This means low maintenance and replacement cost. The sloping-bar design and arrangement of each deck cross member combines the advantages of maximum deck surface with minimum air pressure drop through tower.

Complete Prefabrication of Structure

Only Fluor Counterflo Cooling Towers are completely prefabricated. This offers many advantages to the operator. Tower parts are "packaged" for rapid delivery, marked for orderly erection. Erection is faster, easier, at lower cost. All cutting, drilling and nailing is completed at the factory. Prefabrication means standardization—low-cost replacement of standard parts that may become damaged over the years. It means uniformity in both performance and appearance.

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SINCE 1890

quently had to headquarter in a community 100 miles or more from the scene of construction activity. This meant a round trip of 200 miles each day getting to and from work.

In building the 30-inch crossover line to San Francisco in 1950, spreads were more than 100 miles from a doctor for many weeks. Safety engineers, specially trained in first aid, were kept on duty. Fortunately, during this time there were no serious accidents.

The lack of water was another factor to be contended with. Water trucks had to be put into operation hauling water to the site of pipe line to serve both the crews and their equipment. The crossover line, again, was unusually difficult as far as the water problem was concerned. The line was laid during summertime. Temperatures were 130 degrees or more in the sun (what it was in the shade would be difficult to say; there was no shade). The pipe line road was extremely dusty. The dust from the road, as a matter of fact, was so thick that it clogged the equipment. It was found necessary, therefore, to spray the area with water to keep the dust down. The distance from water to the pipe line was from 80 to 100 miles. Four trucks were put into operation just to haul water to the scene of construction.

Too Much Water

Occasionally the company incurred the problem of too much water. In laying a 10¾-inch lateral line from the 26-inch line to Phoenix, for example, the line had to be put across the Gila River. At the point at which the crossing was made, the Gila is an underground river. As fast as the ditch could be dug, it caved in because of the action of water flowing in. Building a bridge was not justified; the expense would have been too great in view of the volumes of gas to be moved through the line.

El Paso Natural Gas Company men, therefore, put well points into the ground along both sides of the ditch. There was one point for every 18 inches. Five pumps, delivering 4000 gallons of water each, were put to work on these points. Water was pulled away from both the upstream and the downstream side of the ditch faster than it was flowing and the ditch, therefore, remained dry. The crossing was nearly one-half mile in length. The pumps were kept in continuous operation for two months while the ditch was being dug and the pipe laid. The well points went 25 feet below the surface.

Too much water was a problem at 18 points along the pipe lines where it was found necessary to build pipe line bridges. El Paso Natural Gas Company, with these 18 bridges in service, has about four miles of pipe hung up in the air on bridges. These bridges are across the Canadian River, Pecos River, Rio Grande, San Pedro, Gila River, Colorado River and San Juan River.

In building the San Juan pipe line, the company ran into a new type obstacle, if this is the proper term. The route of this line is through the area which was the center of the great Pueblo Indian civilization. Buried beneath the ground are many dwellings, artifacts, and other remnants of these ancient peoples.

. . . . buried treasures

The Antiquities Act of 1908 provides penalties for molesting, excavating, damaging, or otherwise harming ancient landmarks and other objects of national interest. To comply with this act, El Paso Natural Gas Company employed five archaeologists on its payroll. These men worked ahead of the pipe line crews, removing any items of archaeological interest and value before the dozers and trenching machines arrived. These men worked in cooperation with and under the direction of Dr. Jesse Nusbaum of the National Park Service.

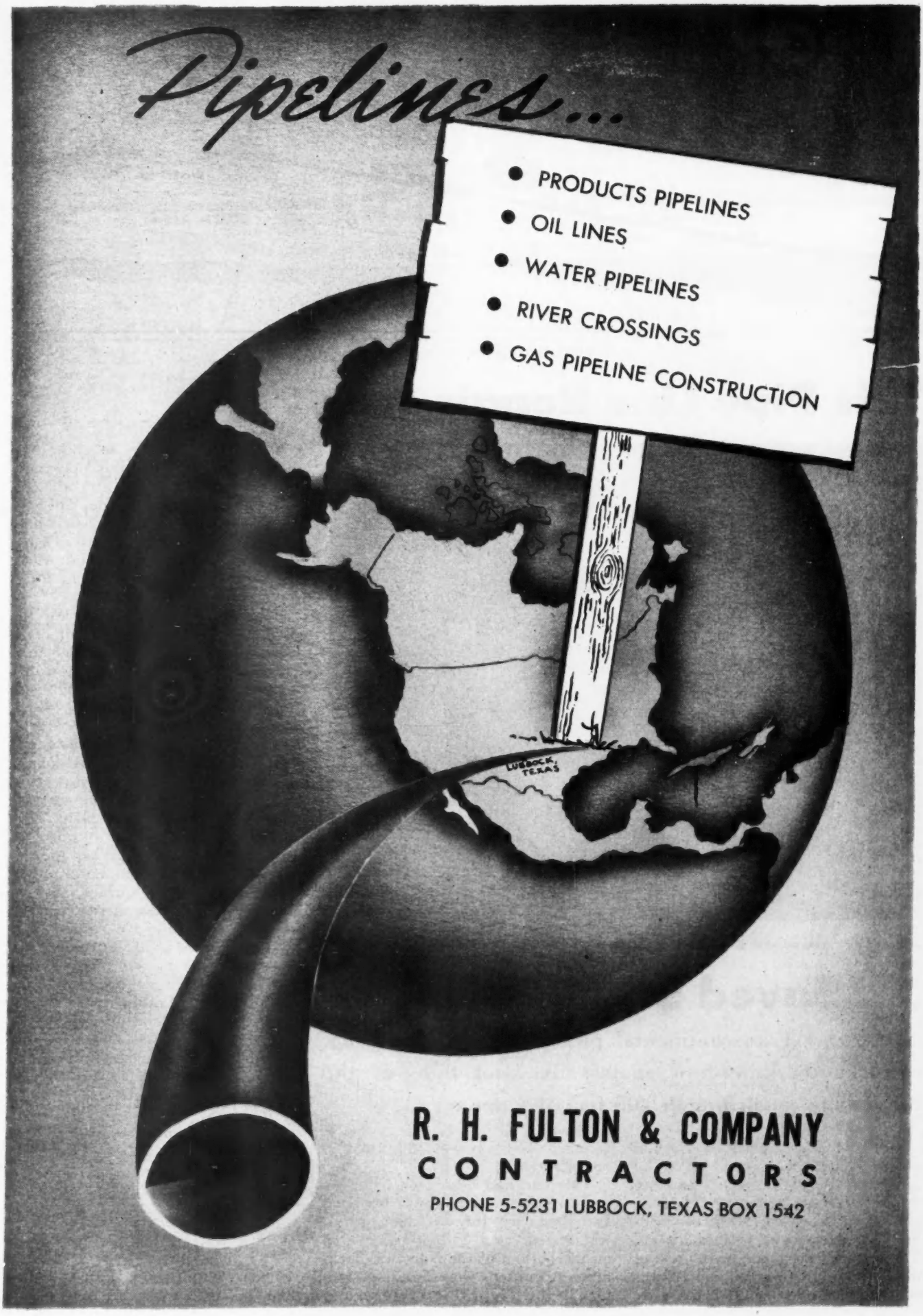
There were 146 sites encountered along the pipe line route. Some of these were single dwellings. Others were significant groups of dwellings. Fifty-two sites were in New Mexico; 84 were found in Arizona. The time range of the dwellings excavated extended from the Basket Maker III A. D. 500-700 to the post Columbian Navajo hogans. Along Willow Creek and about 50 miles west of Seligman, Arizona, ten sites comprising more than 30 structures were located in an area whose archaeology was not previously known.

6086 Miles of Pipe

In its current expansion programs, El Paso Natural Gas Company is adding centrifugal compressors powered by gas turbines. There will be ten of these stations with a total of 140,000 horsepower. These stations, plus the reciprocating stations of the company now in operation or under construction will develop a total of 595,000 horsepower, an altogether major increase over the 50,900 horsepower in operation in 1946. The company now has 6086 miles of pipe line in operation and is constructing 314 additional miles. This is in comparison to 2170 miles of pipe in 1945. Applications are pending with Federal Power Commission for further expansion as has been said. All in all, El Paso Natural Gas Company employes feel that their company has come a long way in the last six years and that much of the growth has been full of interest.

About the Author

C. L. PERKINS is vice president and general superintendent of El Paso Natural Gas Company. He directs the company's operations and its expansion program. Perkins has been with the company for 22 years. During that time the organization has increased the volume of deliveries by 8000 percent. In addition to his present position, he has served as superintendent of gas treating, superintendent of the Jal (now Permian) division, transmission superintendent and assistant general superintendent. He is chairman of the Transmission Section of the Southern Gas Association.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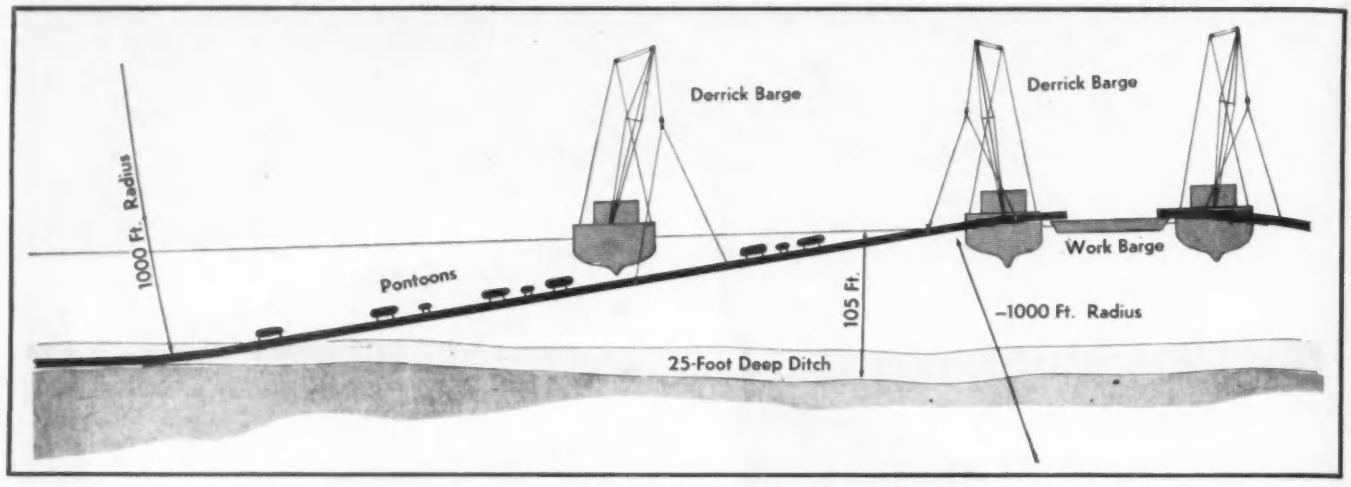
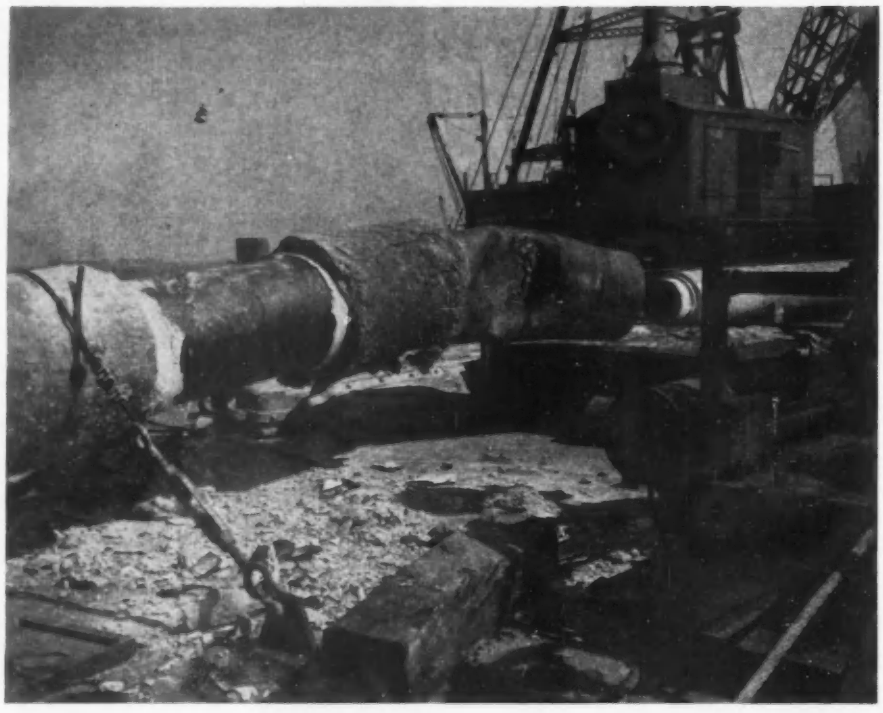


Artist's sketch of how repair job was done.

This Pipe Line Repair Job . . .



Damaged pipe rests on work barge. Buckled section marks point where ship's anchor caught pipe.

. . . Saved $500,000

Transcontinental pitted sound engineering, construction know-how against five-knot tides of the Narrows to repair line in 105 feet of water.

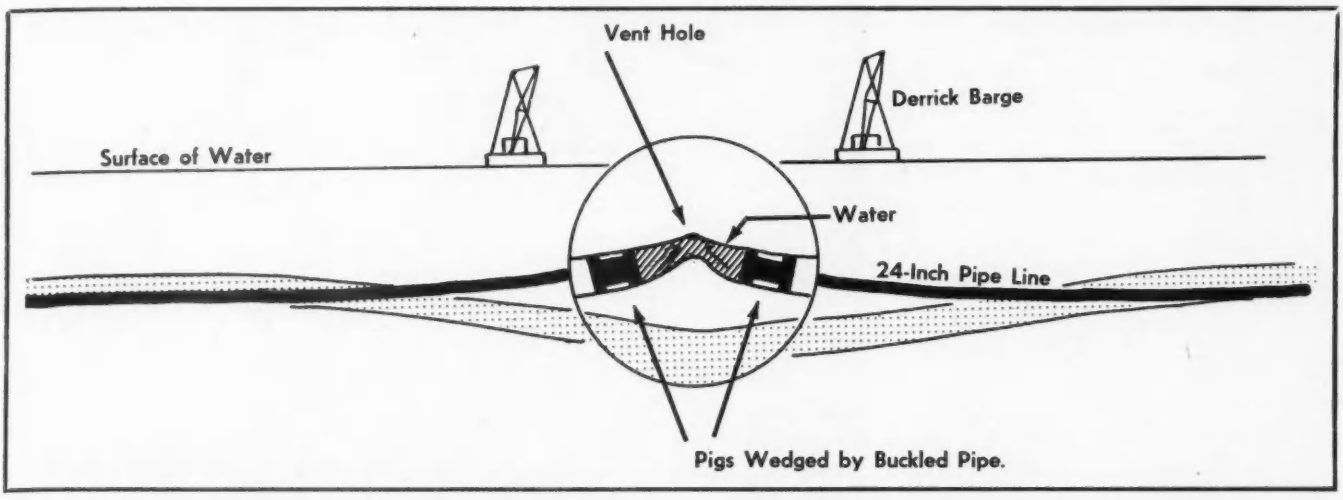
TRANSCONTINENTAL Gas Pipe Line Company saved an estimated $500,000 by repairing rather than replacing—the 24-inch pipe line across the Narrows, principal entrance to New York harbor. The repairs were made in 105 feet of water, despite the five-knot tides which sweep the 6600-foot-wide channel. The job was completed in one month.

This line had been completed between Staten Island and Brooklyn last June (see July WORLD OIL). It was resting in a 25-foot open ditch on the bottom of the Narrows. Backfilling operations were awaiting completion of eight-inch electrical conduits which were to share the ditch. It was during this operation, that a ship dropped anchor and hooked onto Transco's line. The vessel dragged the concrete-coated pipe 80 feet upstream from its original position. The pipe buckled where the anchor hooked it. It had to be repaired or replaced.

Transco officials considered the problem. Any successful repair operation would likely be cheaper than removing the line from the water, reconditioning it and starting over. On the other hand, any plan for repairs would be difficult.

Tides were swift; the repairs would have to be made in the middle of the world's busiest water highway. After studying the problem, Transco engineers came up with this plan: They would attach pontoons to the line on both sides of the break. When the line was sufficiently buoyant, barge cranes would lift it to the surface, and lay the damaged section across a work barge. Then, while the barge cranes held the line in a level position, the damaged section would be cut out and replaced. Then the line would be lowered back into the ditch, and any slack would be taken up by winches, pulling from the Brooklyn shore. In case the slack could not be removed by the winches the line could be jetted to a contour which would take up the slack.

This plan sounds simple. Actually, it presented a difficult engineering problem. The line had to be lifted from the ditch to the surface in such a way that the underbends and overbends would have a radius of at least 1000 feet. At this radius, the tensile stress in the pipe wall would be about 30,000 pounds per square inch, which



Pigs served as corks to keep water out of pipe line when it was cut. After first pig was wedged in place by the buckled pipe, a vent hole was cut in pipe at the break to permit an additional pig to be run from the opposite side.

is well below the minimum yield point.

A sharper bend could easily buckle or permanently deform the pipe.

The great weight of the pipe made the problem more difficult. The half-inch wall, 24-inch pipe, with its three-inch concrete jacket and 5/8-inch mastic coat weighed about 563 pounds per foot. Filled with air or gas, it would weigh slightly over 200 pounds per lineal foot.

Another factor which made repairs difficult was the location of the break. It was almost at the mid-point of the Narrows, about 200 feet inside the anchorage limit.

Transcontinental engineers went into a huddle. They juggled pontoons and barge cranes in mathematical gymnastics. They calculated buoyancies, studied tide tables and worried about the effects of winds and waves. Finally they came up with a tentative plan for raising and lowering the pipe.

The plan called for two barge cranes on each side of the break. These cranes would lift the pipe with the assistance of five large pontoons on one side and six on the other. Three small pontoons were to be spotted at various points on each side.

In their reports, Transco engineers warned that the plan contained elements of risk. A miscue in spotting the large pontoons or barge cranes could result in further damage to the pipe and an additional repair job.

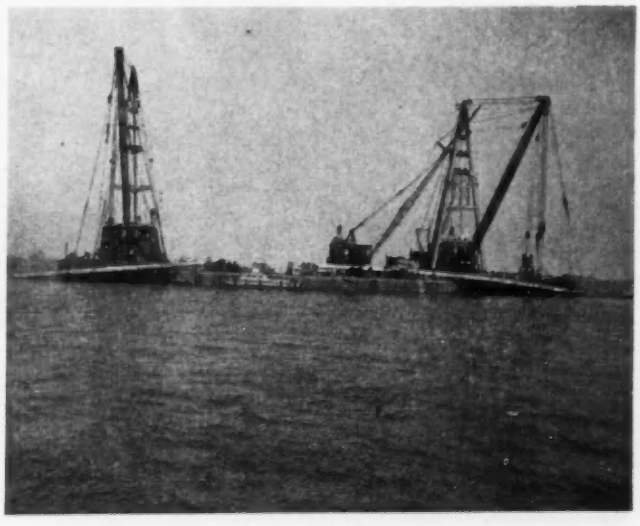
Transco officials called in consulting engineers. When they reported identical findings, Transco officials put the plan into effect.

A contract for the repairs was let to Merritt-Chapman and Scott Corporation of New York.

The work would be under the direction of Raymond H. Crowe, Chief Engineer for Transcontinental. Supervising the work for Transcontinental were Carl Whitaker, Chief Inspector, Jim Crawford, Stanley Smith and Sal Bellassai, engineers. In charge of the work for Merritt-Chapman and Scott was J. T. Denton, Superintendent of the Construction Department, assisted by Dave Hill and "Slim" Alger, superintendents. In charge of derricks during the operation was Gene Howell, Superintendent of the Derick Department.

Late in August, equipment had been mobilized in the Narrows and construction forces set about repairing the line. From the first, it was realized that tides would govern the speed of repairs. Divers could work only in the periods of slack tide. This period varied from 1 hour to 1½ hours in the slack period before ebb tide. It varied from 15 minutes to one hour in the period before flood tide. To further complicate the work, the

Diver Gus Marcussen holds jet hose used to clear silt from under pipe so pontoons could be attached.



Repairs underway on work barge. Note the long radius of bends in pipe.

tides at surface would often be at variance with tides on bottom. There were times when surface tide would be flooding; and the tide at lower depth would be ebbing.

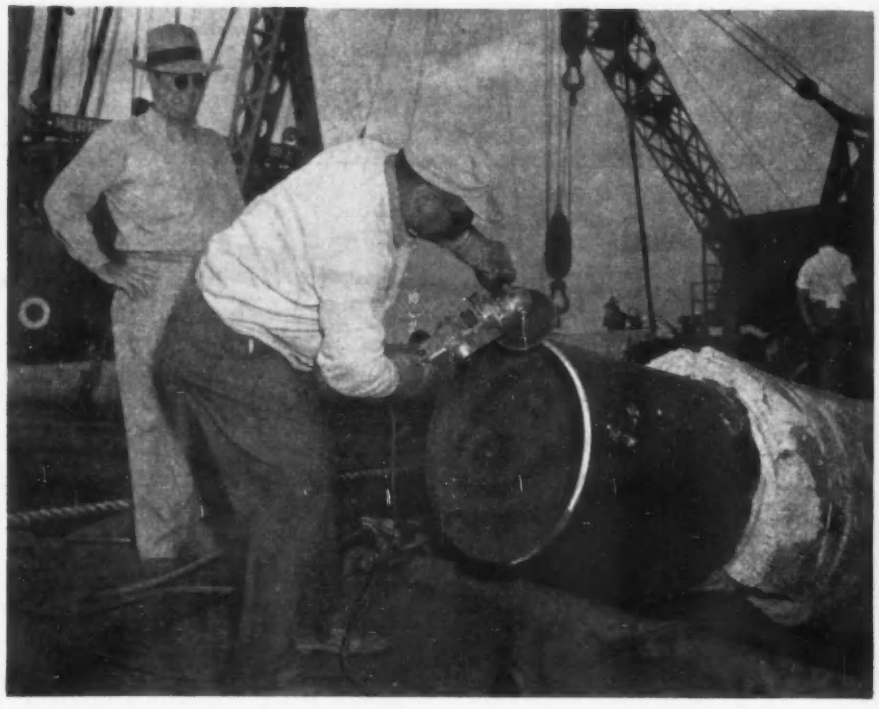
First Stage of Repair

The first problem was to lift the pipe to the surface. Working in pairs, divers attached six large pontoons to the pipe on the Brooklyn side of the break and five on the Staten Island side. The positioning of the pontoons was difficult. They were filled with water and lowered to the predetermined locations. Working in pairs, divers jetted silt and sand from around the line and attached the tongs at each end of the pontoons to the pipe. Then the barge crane lifted the pontoon enough to keep the tongs clamped to the pipe while the water inside the pontoon was displaced with 45-pound air pressure. Each of these large pontoons could lift 22,000 pounds.

Three small pontoons, which could lift 2340 pounds each, were spotted at certain locations on each side of the break. They were attached to the line with 1¼-inch wire rope chokers.

A novel scheme was used to keep water out of the line during lifting operations. Pigs were run into each side of the break. Backed up with air pressure, they acted like corks. When the first pig was run in the line, the end of the pipe across the channel opened. The pig ran freely until it hit the buckled section of the line. Here it stopped and became wedged.

Air pressure was maintained on this section of the line to hold this pig in place. Then one of the divers burned a hole in the pipe at the point of the break. This permitted gas and water to escape from the line as a pig was forced to the pipe from the opposite side of the channel.



A bevel is ground in preparation for the first weld. In the background is Carl Whitaker, chief inspector for Transcontinental.

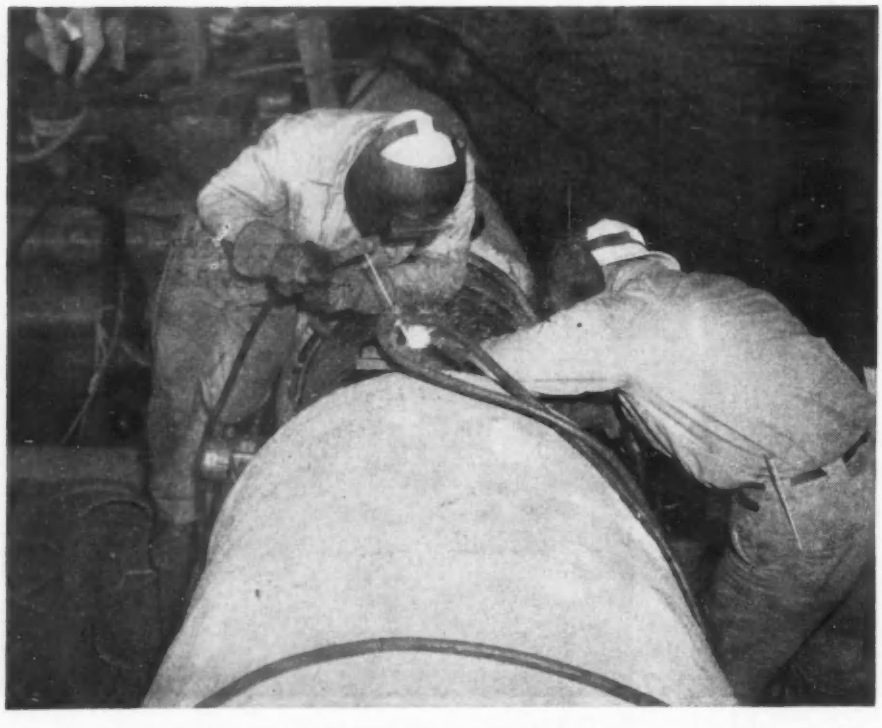
This second pig also became wedged. Together the pigs sealed water out of the line.

The work during this stage of the operations was done from the derrick barge "California." It took two weeks to complete. Divers who worked the pontoons in place were: Merritt and John Tooker, Gus Marcussen, Olaf Danielson, John Walter, Joe Pollus and Dick Boeckel.

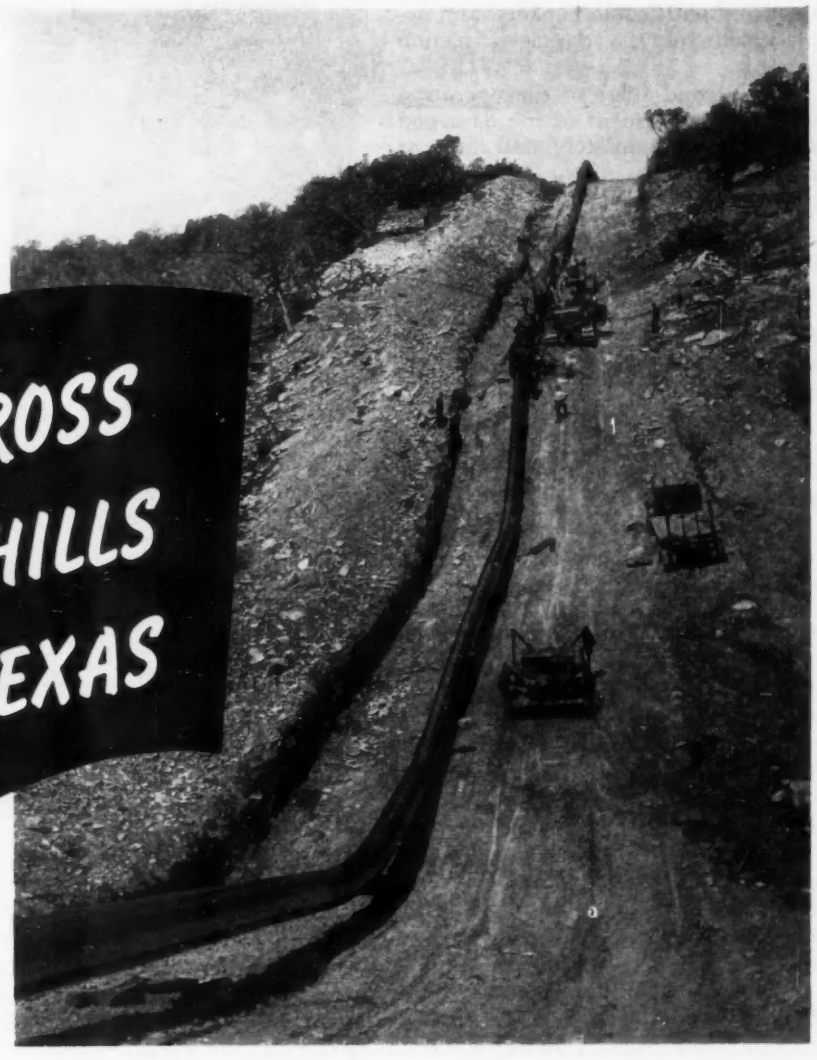
After stage one was completed, four derricks were brougnt out on the Narrows and set in so they could lift approximately 1500 feet of line off the bottom. The "Colossus" and "Challenger," each with a 100 ton lifting capacity, were set in the middle, 75 feet on either side of the damaged area. Two-hundred-and-fifty feet to the outside of these derricks, the "California" and the "Chief," each with a lifting capacity of 90 tons, were set in.

This placing of derricks presented quite a problem. Anchor lines were approximately 1200 feet long and overlapped in the short working area. For this difficult job in the strong tides, six anchors instead of the usual four were used on each derrick.

With the four derricks in place and a 34 x 137-foot deck scow in readiness, the major step in the repair was taken. A diver line was cut in area of the buckle, and the lift began. When the two ends of the pipe came to surface, they were held aloft and the deck scow was moved under them. Then the line was made fast to



Here the welders go to work on first lineup. Choppy waters of the Narrows made welding operations difficult.



SNAKING ACROSS THE ROCKY HILLS OF WEST TEXAS

● Associated used two 26 inch pipe line spreads to complete their 120 mile section in West Texas on this 466 mile, 26 inch oil line for West Texas Gulf Pipe Line Company from Colorado City to Jefferson County, Texas.

Steep, rocky hills like this were typical of the terrain through which our crews laid the 26 inch line.

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the scow with cable chokers, and replacement of the damaged section began.

The second stage of the operation was the replacement of the damaged section. Approximately 110 feet of pipe was cut out of the line and replaced.

Lining up and welding of the pipe presented a problem since choppy water, ground swells and the changing tides in the river affected the work. Three joints of pipe were used to make the repair. Each of the welds was X-rayed and coated with mastic coating and three inches of concrete placed over the coating. Stage two of the operation took three days to complete.

Because there was no slack in the line, and the pipe had to be repaired at surface, the overall length of the crossing was increased during repairs. This would leave unwanted slack in the line. An attempt was made to pull this slack out of the line as it was slowly lowered to the ditch. A heavy winch imbedded in the earth on the Brooklyn shore held a 240,000 strain on the pipe as it was lowered. But this was to little or no avail.

When the pipe reached bottom, and the pontoons were released, it stood 10 feet above grade, resting on the slope of the trench approximately 65 feet north of its original position.

The slings were then re-attached to the pipe line and a pull was made with the "California" and the "Chief" in an effort to work the slack in the line back to the center line of the trench. The pipe was moved some distance. However, after the final pull was made, the pipe remained approximately nine feet above grade.

At this point it was decided to jet the pipe down to grade in its present location by the jet and airlift method.

Divers and pipeliner on job. Left to right are: Diver Merritt Tooker, Jim Crawford, Transco assistant chief engineer, Eastern Division; Diver John Tooker, Tender Red Evans and in front, Tender Aristotle Mochos.

A 10-inch pipe 95 feet long was rigged up for this operation. The jetting head consisted of two 3-inch jet hoses and one 2-inch air hose. The water pressure was supplied by two 3-inch pumps each pump working at 200 pounds pressure. The air was supplied by two 500 CFM compressors each working at 90 pounds and pumped through a receiving tank. The jet pipe was placed by a diver at slack tide and the area worked during the tide was investigated on each of these dives.

This method proved successful. The pipe was jetted down to grade. This jetting operation was under the direction of Finn Nord, who also did the diving on this operation.

At the completion of the jetting operation, a diver walked the area and soundings were made at that time. A small deck scow rigged with anchors, was used for the diving operation. The scow was furnished by Gates Brothers Marine Service, who also were charged with the patrolling of the pipe line until the back filling was completed.

Before the repaired section of the pipe line was backfilled, the pipe line was pressured to 750 p.s.i.g. and dead weighted for 48 hours. Backfilling of the line was done by Construction Aggregates Corporation, using the "Sandcaptain," a suction dredge. The backfill material was heavy sand. The pipe line was backfilled to a minimum of 15 feet over the top of the pipe.

Pontoon pops to surface after pipe was repaired and lowered. Because length of pipe line was increased during repairs, there was too much slack in ditch. Pipe was jetted to proper contours using air and high-pressure water.

Set 'em and forget 'em

The valve that seals tightly, operates easily, and requires the least maintenance and attention deserves top priority. That's the Cameron Non-Lubricated Lift Plug Valve.

It seals tightly because of a novel mechanical design which employs a seat separate from the body which is, therefore, not affected by pressure forces and line strains. It operates easily because of the lift-turn-reseat principle which eliminates friction between the plug and seat. It requires minimum maintenance because it does not depend on lubricant to effect a seal or for easy operation. And being non-lubricated, it also eliminates the possibility of contaminating line products.

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1 This is it.

2 Rod welded to six-inch pipe turns short-handled chain tong.

3 Stabbing three-inch pipe.

The 'Hired Hand'

Farm tractor with a trick transmission set records in making up and breaking out pipe.

By W. E. SMITH, JR.
Hiawatha Gas and Oil Company, Benevides, Texas

HERE's a "Hired Hand" that can make-up 3400 feet of three-inch screw pipe in 3½ hours—about 1000 feet an hour, and that's pipelining! Two-inch pipe is less of a chore, and the "Hired Hand" makes it up so fast that it's all a crew can do to keep up with it.

The new "hand" is a farm tractor with a trick rear transmission. Its drive can be latched onto a piece of pipe with a converted chain tong; and when the operator throws it in gear, it will turn the pipe to the right or to the left, depending on whether pipe is being made-up or broken-out. All the crew has to do is to stab the pipe joint, set "back-up" tongs on the previous joint and then hold the end of the pipe at the proper height while the operator backs the machine up to the pipe.

This machine was developed to fill a specific need. In and around Benevides, Texas, Hiawatha Gas and Oil Company hands are required to lay many miles of small-inch gathering lines every year. Making-up screw pipe by hand with chain tongs is a slow and arduous task. W. W. (Bill) Sawyer, assistant superintendent in the area, had the idea for this machine.

He carried his plans to W. Bill Klemcke, another Hiawatha employe, who made the device in the company shop. He used an old truck transmission, a short piece of six-inch pipe, welding rod and scrap steel.

Here's the way it works. The truck transmission is mounted on a bracket at rear of the tractor and ties to the power takeoff. A short length of six-inch pipe, welded to the transmission shaft, cradles the pipe as it is being made up. When the transmission is in gear, the six-inch pipe turns. A rod welded to the six-inch turns a short-handled chain tong, which is slipped around each individual piece of pipe.

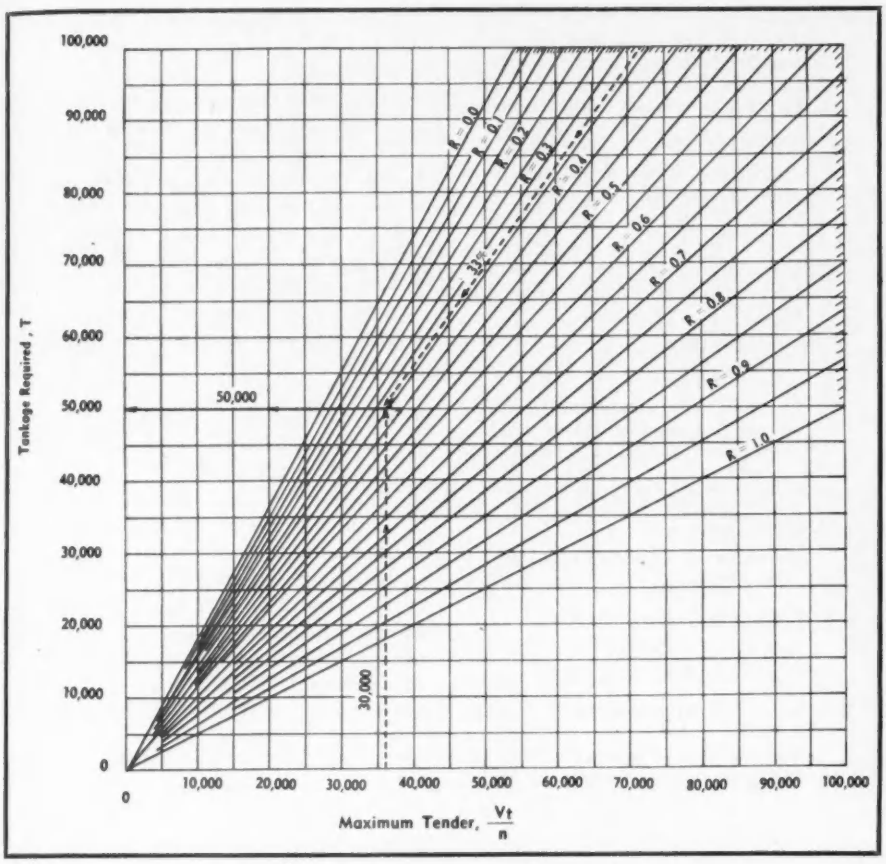
When the pipe is made up to proper torque the chain tong is removed and the tractor moves to the next joint.

4 Special skid with backup tongs.

5 1000 feet of three-inch pipe an hour.

6 Pipelining through brush country.

Photos courtesy *The Pioneer*.



Graph for Computing Tank Size

How to Compute Tank Sizes For Products Terminals

Here's a proven formula for figuring minimum adequate tankage for each product.

By RALPH B. RODGERS and SPENCER HALLBERG
Standard Oil Company (Indiana)

SINCE COST of tankage is a major item in the initial investment of products pipe line terminals, it is important that tanks be of proper size at each terminal. Tanks should be sized to provide for future increases in terminal throughput, as well as tank working room for operation of the line under adverse conditions without erecting excessive tankage.

With costs and pipe line operation in mind, a formula based on operating experience has been derived by the Products Pipe Line Department of Standard Oil Company (Indiana). This formula provides a safe minimum tank size to handle required terminal volume. At the same time it provides tankage for foreseeable increases in terminal throughput and permits a reasonable number of tenders each month.

Basis of Method

One tank is usually provided for each product at a terminal. This formula is developed on that basis. However, if it is desirable to construct more than one tank for a specific product at a terminal, the total tank volume determined from the formula (before adding space for tank bottoms and outage at top) can be divided by the number of equal volume tanks desired.

The proper tank size for a specific product at a terminal is obtained by an analysis of a five-year forecast of estimated volume requirements in order to allow for future demands. The volume selected is the maximum estimated to be shipped from the terminal in any month during such period; and the corresponding pipe line receipt for that month.

To calculate tankage by the formula the following data are required:

- Maximum monthly volume of the product to be shipped from the terminal.
- Total maximum monthly volume of the product to be pumped through the pipe line immediately upstream from the terminal.
- Total maximum monthly volume of all products to be pumped through the pipe line immediately upstream from the terminal.
- Number of tenders of the product to be pumped during each month.
- Allowance of tank space for overshipment of product by terminal (estimated to be one-third of the terminal requirement between receipt of tenders).

A terminal will usually overship during certain periods of the

Key to Graph

Minimum Tankage Requirements for Pipe Line Terminals

$$T \quad \frac{V_t}{n} \quad (11/6\text{-}4R3)$$

T = Working tank volume required (excluding allowance for weekend arrival; and tops and bottoms).
V_t = Maximum monthly volume of the product to be shipped from the terminal in barrels.
n = Number of tenders of the product to be pumped each month.
R = Portion of the month the terminal will receive product.
$R = v_p/v_L$
v_p = Total monthly volume of the product to be pumped through the pipe line immediately upstream from the terminal barrels.
v_L = Total monthly volume of all products to be pumped through the pipe line immediately upstream from the terminal in barrels.
$v_t/15$ = Weekend arrival of product at terminal.

DIRECTIONS:

1. Calculate the maximum tender (v_t/n) and the portion of the month the terminal will receive the product (R).
2. Find the intersection of the above (V_t/N and R).
3. Read the tankage required on the tankage (T) scale.
4. Add allowance for weekend arrival ($v_t/15$) and tops and bottoms.
5. If the maximum tender (V_t/n) is greater than 100,000 multiply its scale and the tankage (T) scale by 10. Conversely, if the maximum tender is less than 100,000 divide its scale and tankage scale by 10.

month, a condition which may be caused by such factors as unfavorable weather forecasts, threatened strike, or upward price adjustments.

- Allowance of tank space for undershipment of product by terminal (estimated to be one-half of the maximum tender to be delivered to terminal).

When a product tender is pumped into a pipe line, each terminal must have sufficient tank space available to hold its proportional share of the total tender in the event of bad weather, reduced demand, inability to ship, strikes, etc. Operating under this principle avoids a line shutdown during localized adverse conditions which would disrupt receipt of needed stocks at terminals operating under normal conditions.

- Allowance for arrival of product on nonshipping days (week-end arrival). Calculated by multiplying the daily average shipping rate by two.
- Allowance of outages for tops and bottoms. Outages are added after proper tank size is determined, since allowance varies with diameter and type of tank. (Normally a total of three feet of space is allowed for tops and bottoms of cone roof tanks and a total of four feet of space for tanks of the floating roof or lifter type.)

Development of Tankage Formula

Symbols to be used are as follows:

V_t = maximum monthly volume of the product to be shipped from terminal in barrels.

V_p = total monthly volume of the product to be pumped through the pipe line immediately upstream from terminal in barrels.

V_L = total monthly volume of all products to be pumped through the pipe line immediately upstream from terminal in barrels.

n = normal number of tenders of the product to be pumped during each month.

$R = V_p/V_L$ portion of month the terminal will receive the product.

Q_1 = quantity required between tenders.

Q_2 = quantity required for undershipments.

Q_3 = quantity required for overshipments.

Q_4 = quantity required for week-end arrival of product.

T = total working tank volume required (excluding tops and bottoms).

Derivation of Formula

T = quantity required between tenders, plus one-half maximum tender (undershipments), plus one-third quantity required between tenders (overshipments), plus quantity shipped in two days (week-end arrival).

$$T = Q_1 + Q_2 + Q_3 + Q_4$$

Q_1 = quantity required between tenders. The maximum monthly volume of the product to be shipped from terminal (V_t) minus quantity shipped from tank while receiving product ($V_t \times \frac{V_p}{V_L}$ or $V_t \times R$) divided by number of tenders of product pumped (n).

$$= \frac{V_t - (V_t \times R)}{n}$$

$$= \frac{V_t}{n} - \frac{V_t}{n} \times R$$

$$= \frac{V_t}{n}(1 - R)$$

Q_2 = undershipments. One-half of maximum terminal volume on specific product (V_t) divided by number of tenders (n).

$$= \tfrac{1}{2}\frac{V_t}{n} = \frac{V_t}{2n}$$

Q_3 = overshipments. One-third of quantity required between tenders (Q_1).

$$= \tfrac{1}{3} Q_1 = \tfrac{1}{3}\frac{V_t}{n}(1 - R)$$

$$= \frac{V_t}{3n}(1 - R)$$

Q_4 = week-end arrival — two shipping days. Volume from terminal (V_t) divided by 30, multiplied by 2.

$$= \frac{V_t}{30} \times 2 = \frac{V_t}{15}$$

Since:

$$T = Q_1 + Q_2 + Q_3 + Q_4$$

Then:

$$T = \frac{V_t}{n}(1 - R) + \frac{V_t}{2n} + \frac{V_t}{3n}(1 - R) + \frac{V_t}{15}$$

$$= \frac{V_t}{n}(1 - R + \tfrac{1}{2} + \tfrac{1}{3} - R/3) + V_t/15$$

$$T = \frac{V_t}{n}(11/6 - 4R/3) + \frac{V_t}{15}$$

Note: Formula for T is not factored further because graph is plotted with $\frac{V_t}{n}$ as abscissa.

Determination of Tank Size by Graph

To represent the tankage formula graphically, it is necessary to omit allowance for the two nonshipping days for weekend arrival of product ($V_t/15$). This amount must be added to the volume determined from the graphs in order to select proper tank size exclusive of outages (tops and bottoms). Graph is constructed by using the maximum tender as abscissa and tank volume required as ordinate with a series of curves representing the portion of time the terminal will receive the product. (Stepwise method of developing graph can be found at the end of this article.)

The following example explains how the size of a terminal tank is determined by the graphical method:

Problem: To calculate size of tank required for heater oil No. 1 at Terminal "X."

Conditions:

- Maximum monthly volume of heater oil No. 1 to be shipped from Terminal "X" = 72,000 barrels.
- Total monthly volume of heater oil No. 1 pumped through the pipe line immediately upstream from Terminal "X" = 300,000 barrels.
- Total monthly volume of all products to be pumped through the pipe line immediately upstream from Terminal "X" = 900,000 barrels.
- Normal number of tenders of the product to be pumped during each month = 2.

(In a 30-day month, with two tenders per month, tenders are 15 days apart.)

Tank size is selected by graphical method by determining (1) the maximum tender V_t/n and (2) the portion of the month terminal receives the product $V_t/V_L = R$. Using example above:

$$\frac{V_t}{n} = \frac{72{,}000}{2} = 36{,}000$$

$$R = \frac{V_p}{V_L} = \frac{300{,}000}{900{,}000} = 0.333$$

Read across bottom of graph, "Maximum Tender Size," to 36,000 and then vertically to intersect a line where R equals 0.333; thence, from this point of intersection horizontally across graphs to read volume as 50,000 barrels. Since the graph does not include the two nonshipping days, we must add 4800 barrels to determine volume to be 54,800 barrels (exclusive of outages).

$$\text{Nonshipping days} = \frac{V_t}{15}$$

$$\frac{V_t}{15} = \frac{72{,}000}{15} = 4{,}800$$

The tank size as determined by this method will adequately handle volumes for all months regardless of seasonal changes.

Preparation of Charts

In the preparation of graphs for tankage, using the method outlined here, the procedure and requirements are:

- Assume maximum tender of 100,000 barrels.
- Find tankage required by substituting various values of R (portion of month terminal receives stock) in tankage formula.
- Plot values determined in (2) on 100,000-barrel ordinate.
- Draw lines from points plotted in (3) to the original point of the abscissa and ordinate axes.

ACKNOWLEDGMENT

This article from a paper presented at Products Pipe Line Conference API division of Transportation, Fort Worth, April 21, 1952.

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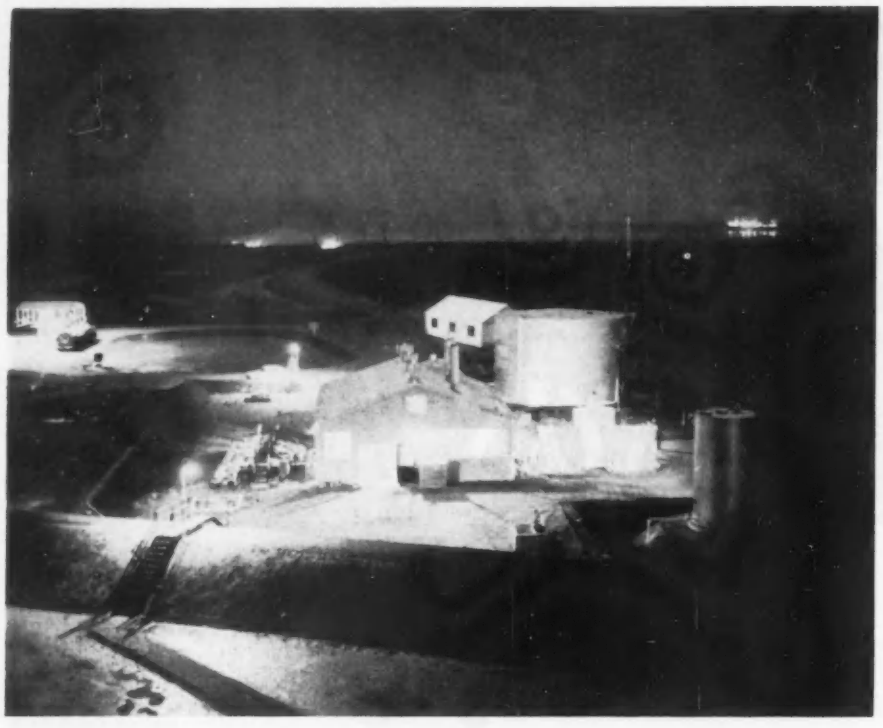


Ventura Marine Terminal in operation. Tanker in upper right is taking on crude at rate of 14,000 barrels an hour and at the same time delivering refined products to storage tanks on shore.

Union Oil Company figures to save plenty with quicker tanker turn-around as its second . . .

Submarine-Line Terminal Is Opened for Business

By JAMES JOSEPH
Bureau Chief, *Western Round-Up*

LAST MONTH a tanker stood off the low-lying shore of Ventura, Calif. From a 20-inch outside diameter submarine line, it took on crude at the rate of 14,000 barrels an hour. Simultaneously, it was delivering to shore storage tanks some 5000 barrels of refined products—including high-test gasoline. A second submerged line, this one eight inches in diameter, allowed this dual pickup and delivery efficiency.

Thus, Union Oil Company's new Ventura Marine Terminal, opened for business only two months ago, became the company's second west coast submarine-line terminal. The other is at Monterrey, a few hundred miles up the California coast. A third marine loading station at Avila, is midway between the two. The Avila station has no submerged pipe lines.

Ashore, and in radio contact with the tanker, operators at the terminal's pump station revved up the two diesel engines to 465 revolutions per minute. Driving centrifugal pumps through speed increasing gears (ratio 3.5:1), the diesels began to move 14,000 barrels of light crude per hour through the submarine line. Within 12 hours after arrival the ship was "turned around" and headed toward Union's Oleum or Wilmington refineries.

"This efficiency," explained one Union executive, "will help keep tanker operational cost down. Every minute we lay over, costs us money."

The new Ventura terminal collects crude (18 to 36 gravity) via 36-mile long, 4-inch and 8-inch pipe lines. The line follows the Santa Clara river valley, bringing crude from such producing fields as Oak Canyon, Newhall-Petrero, Fillmore and from Torrey Canyon—a recent rediscovery. Crude is stored at the terminal in a 135,000-barrel, 43 feet high by 142 feet diameter floating-roof tank. The Santa Paula pump station, about 20 miles up the 8-inch line, is a main distribution point to the terminal.

Union's new facility is a combination pump station for tankers and marketing center for the nearby Ventura area, fast-rising industrially and agriculturally. Tankers from Union's refineries deliver about 5000 barrels of refined products (diesel fuel, "7600" high-test gasoline and Union Oil "76" gasoline) at the same time they pick up about 100,000 barrels of crude.

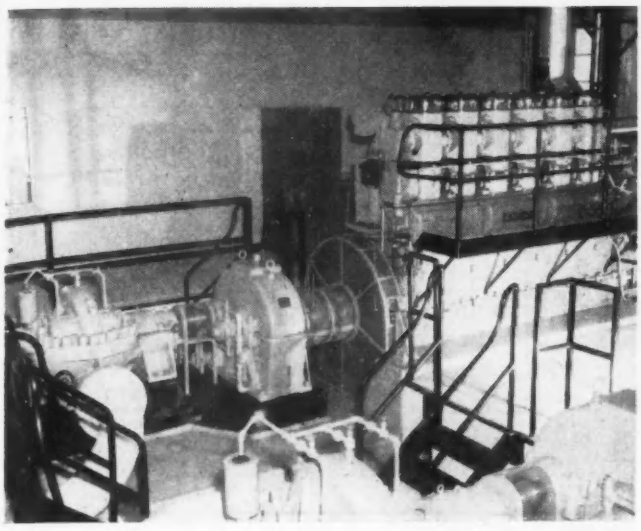
Since tankers don't call every day—in fact, may be spaced seven to ten days apart—the terminal is designed especially for interrupted service. Its design allows a minimum of standby personnel. Only a gauger need visit the facility between tankers. When a tanker is due to arrive, a special crew is assembled at the Santa Paula pump station and driven to the terminal.

From the diesel pump station, two submerged lines extend into the Pacific, 4280 feet and 4200 feet respectively. The former is strictly for crude, the latter for refined products.

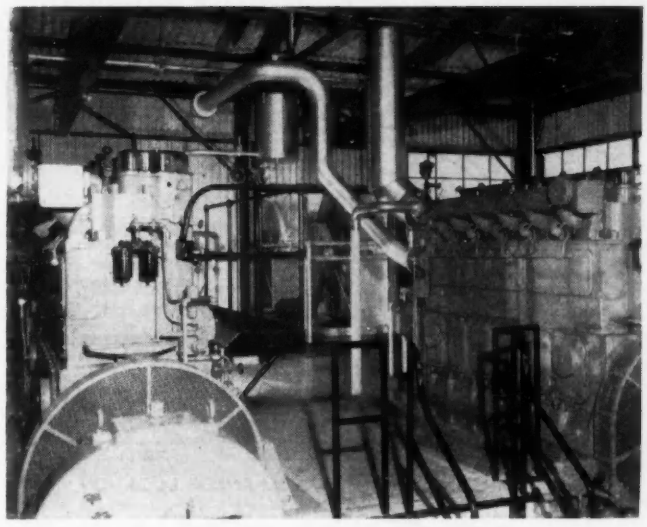
The crude line is 20 inches o.d., with a ¾-inch concrete coating inside. Exteriorly it is covered with an asphaltic pipe wrapping, and over this is ⅝ inch of concrete—which helps weight the pipe and keep it submerged. All coatings were applied before the line was laid. The exterior concrete was gunited over the asphaltic wrapping.

The 4200-foot line, which handles only refined products, is eight inches o.d., coated inside with ⅜ inch of concrete, and covered exteriorly with asphaltic wrapping. This line is not overcoated with concrete. Both, however, are end-connected to 175 feet of flexible hose, which normally lies on the ocean floor, but which is picked up and taken aboard the tanker prior to filling.

Both lines are laid down with oil—



Twin diesels drive pumps through 3½:1 speed increasers. This station was designed for uninterrupted service. Only the gauger needs to visit plant between tanker visits.



Interior of station. Because engines do not run for a week or more between tanker visits, they are equipped with lube oil start-up pumps which circulate oil prior to starting.

even when not in use. Crude fills the larger, helping to weight it and also keeping out salt water. Diesel fuel oil usually fills the smaller.

Tankers arriving from Union's Wilmington or Oleum refineries usually deliver 5000 barrels of refined products to two 30,000-barrel cone-roofed steel tanks for gasoline or to a 10,000-barrel tank for diesel fuel.

The newly constructed pumping station—which is heart of the terminal—houses the two diesels, rated 465 horsepower (usual operation is at 480 rpm, but they can, and sometimes do, operate at 550 rpm). The engines can work in tandem or separately, one standing by. With one in operation, about 8000 barrels an hour can be pumped aboard a tanker. With two working, about 14,500 barrels an hour can be pumped. However, the average hourly delivery rate is more like 11,700—12,000 barrels, figuring hookup, teardown and valving time. This rate still allows for tanker "turn around" in a maximum 12 hours. Tankers have been filled and sent on their way in as little as ten hours.

Engines, working through separate speed increasing gears, drive horizontally split-case, double-suction, single stage centrifugal pumps. Pumps are rated 7500 barrels per hour at 170 pounds per square inch. The 20-inch crude line is thus pressured during pumping to 170 psi.

An interesting feature: each engine's radiator is mounted out-of-doors to reduce noise. These radiators are the split-flow, jacket-water, fan-cooling type, with double cooling systems. The upper section handles lube oil cooling water; the bottom, the engine cooling water. Radiator fans are electrically driven.

The really unusual problem which had to be anticipated in designing the terminal was its interrupted operation. From this emerged a need to "pre-lube" engines which might be shutdown for from a week to ten days—between tanker calls. Important also was the terminal's tidesland location, subject to salt air corrosion. Thus, built into the facility is a "lube-oil start-up" auxiliary pumping system, which circulates lube oil to the diesel engines prior to starting after prolonged shutdowns. A 1-2 h.p. electric motor circulates lube oil through the engines' lube oil system. Lube oil is also changed and the engines refilled by the same auxiliary system.

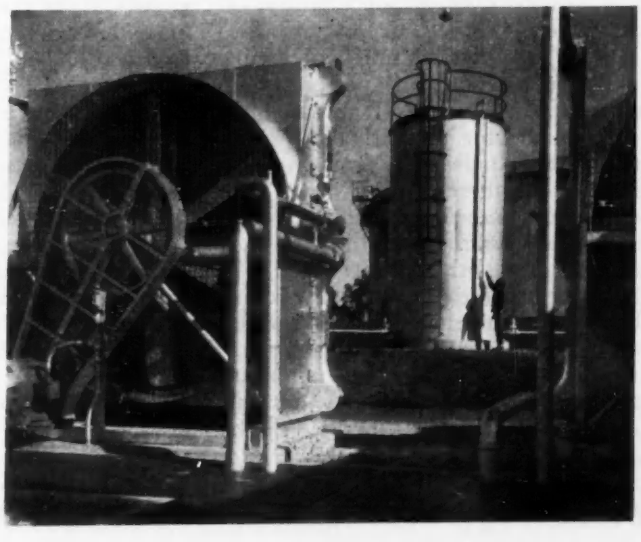
Engine cooling water is softened by a treater before use in the radiators. However, since some small amount of hardness still remains after treatment, the water is after-treated with phosphate.

"This is a first-class manifolding design," one of the pumping station's employes said. He meant, of course, the valving and piping which:

- Allow crude to be pumped into storage tanks from the Santa Paula pipe line.
- Reverse, directing crude or salt water back to Santa Paula.
- Connect terminal pumps to the submarine lines delivering crude to tankers.
- Interconnect storage tanks with pumping facilities.

The station's site is adjacent to the Santa Paula river and is built at an elevation of less than ten feet above sea level. Thus, a system of dikes surrounds the plant. Dikes are designed to protect the plant during periods of high water in the river since the nearby area is subject to flooding during heavy rains. Storage tanks are enclosed with regulation earthen firewalls.

J. H. Robinson is manager of pipe lines for Union; Jack Pate, superintendent, southern division pipe lines, and E. O. (Swede) Tudor, chief superintendent, Santa Paula.



Diesel radiators which have dual cooling system (lube oil and cooling water) are mounted out-of-doors. Tank in rear is for diesel fuel storage.

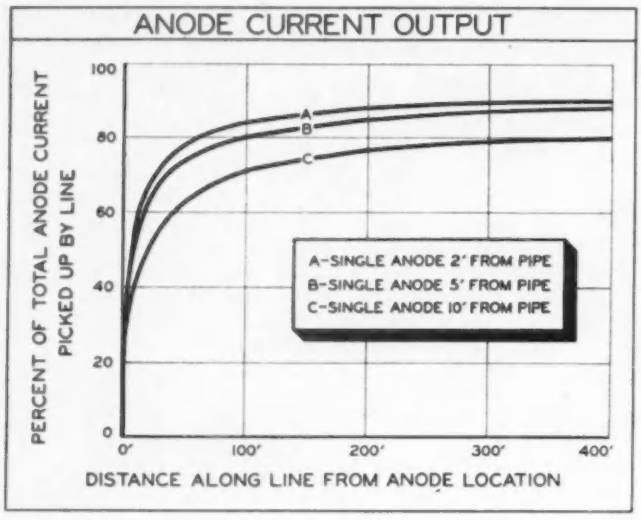


FIGURE 1

Data for these curves obtained from tests employing an 8-inch unpolarized line, soil resistivity 700-900 ohm-cm.

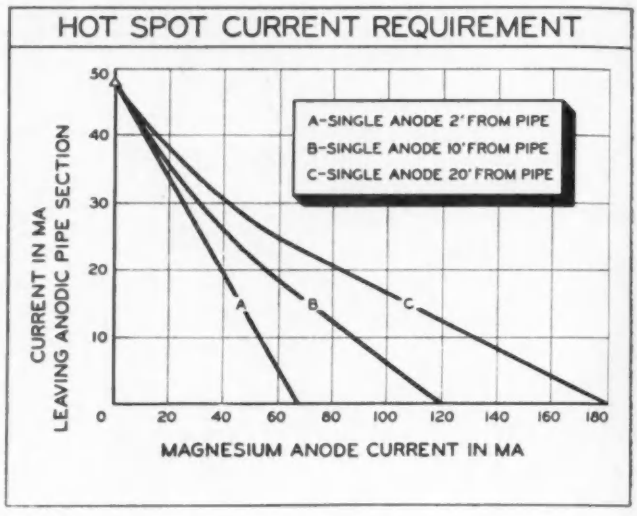


FIGURE 2

These curves represent the amount of anode current required to overcome the current from a manufactured hot-spot.

Proper Anode Spacing Cuts Corrosion Protection Costs

This is the factor which determines current distribution . . . and wasted current is wasted money.

THEORETICALLY, THE minimum current requirements for pipe lines would be met by paralleling the line with a continuous galvanic anode. And, such a system can be designed using extruded, cored magnesium ribbon. Unfortunately, however, in many cathodic protection installations this is not practical due to the relatively low resistivity of the soils. Its use is not recommended in soils below 4000 ohm-cm.

Conversely, the current required to protect a given length of pipe will be the greatest where a large concentrated ground bed is used as the current source. In practice the most economical means of cathodic protection usually is to install a system of distributed, small current stations. This type of installation, employing the principle of distributed grounds, is utilized in the use of cast magnesium anodes for the cathodic protection of bare pipe lines. Even in these installations there is some wasted current in the immediate vicinity of each anode, but usually it will be but one-fifth to one-tenth of that which will be wasted where concentrated ground beds employing high current sources are used.

On bare pipe lines the minimum amount of current which will result in the use of fewer anodes will be obtained by distributing the anodes more or less uniformly along the section of the line to be protected, as against grouping of the anodes. The radial distance between the anode and the pipe for bare line installation also can be an important factor in the current distribution. Here it is desirable that designation of this radial distance be based upon the scope of the installation contemplated (i.e., whether a long or short length of line is involved).

Where long lengths of pipe are involved, usually considered to be those over 1500 feet long, magnesium anodes preferably should be installed at approximately ten feet radial distance from the line. On shorter lengths of pipe line a radial distance of 2-5 feet usually results in fewer anodes doing the job. The difference in radial distances involved is the direct result of current distribution, as illustrated by the curves in Figure 1. From these curves it is evident that more of the total current per anode is picked up in a given length of line as the radial distance between the pipe and the anode is decreased. On short line sections this is beneficial in that fewer anodes may be used to obtain a given current pickup. Another factor tending for the use of fewer anodes on the shorter spacing is the resultant higher current output per anode because of a lower circuit resistance.

A field experiment further emphasizes the more effective use of anodes by installing them close to the corroding pipe sections. In this experiment an abandoned six-inch pipe line was used. A ten-foot section was removed from the line, sand-blasted and reinstalled, with a gap separation of two inches left between the pipe sections. 12-gauge, rubber-covered copper wire was welded to each side of the severed pipe with these copper wires serving as a means of bonding the pipe sections together through either switches or shunts.

The sand-blasted section of pipe, when reinstalled, was placed in a prepared backfill of nine parts clay, one part gypsum, having a resistivity of 620 ohm-cm. By comparison, the remainder of the rusted pipe line originally left in place was in high resistance yellow sand. It was found upon connecting all sections of the pipe line together that a total current of 47.8 Ma. was leaving the manufactured hot-spot and flowing through the soil to the rusted sections of line.

The current from each individual magnesium anode used in the experiment was then increased gradually until the sum of the current flowing from the rusted pipe sections to the ten-foot section in the external circuit was equal to or less than the magnesium anode current. At this point it was assumed that the ten-foot section of pipe was no longer acting as an anode (hot spot) to the rusted sections. The current flow from the individual magnesium anodes, located two, 10 and 20 feet from the pipe line, which was required to stop the current from the manufactured hot spot was approximately 67, 120 and 180 Ma respectively. These data are plotted and shown graphically in Figure 2.

ACKNOWLEDGEMENT

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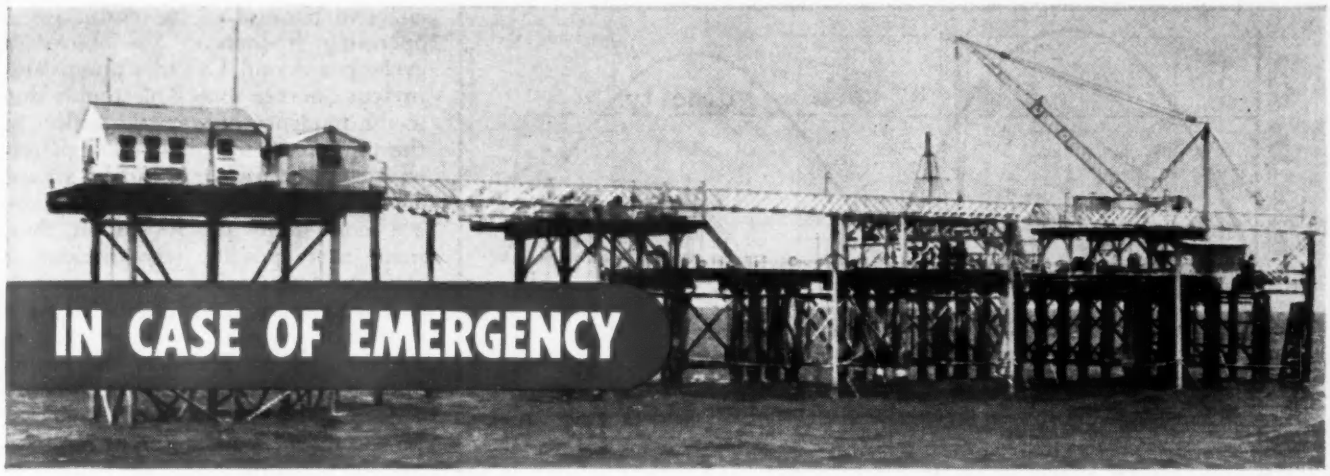

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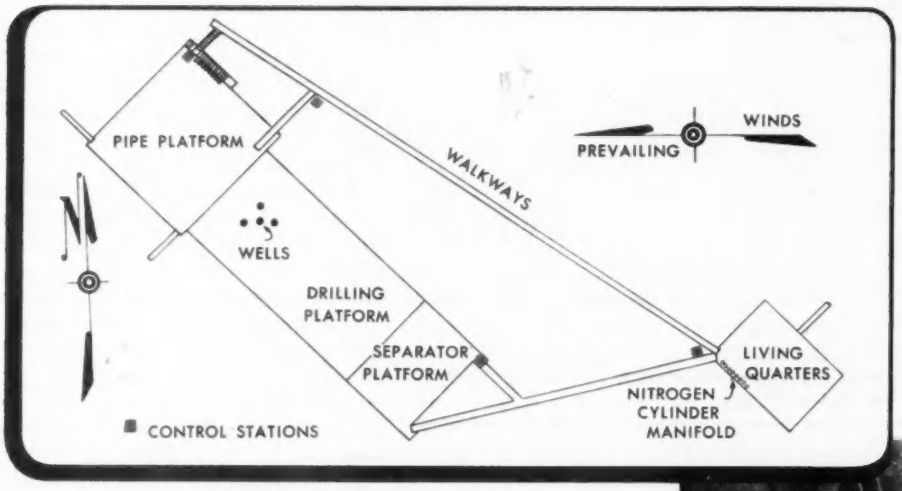

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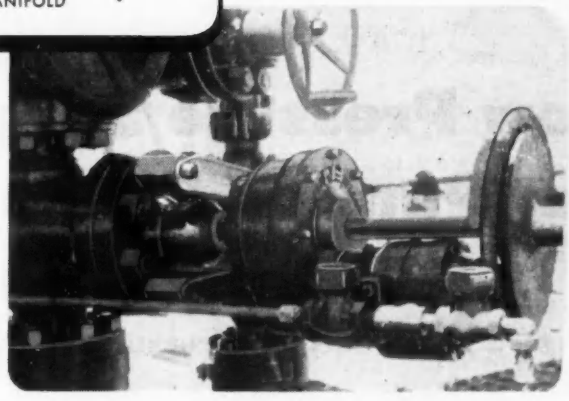

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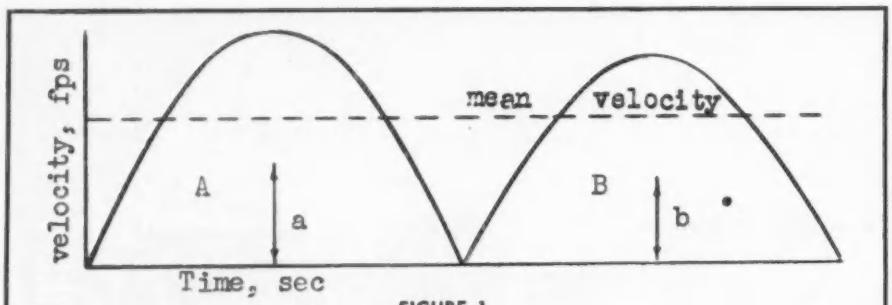


FIGURE 1
Time-Velocity curve without desurger.

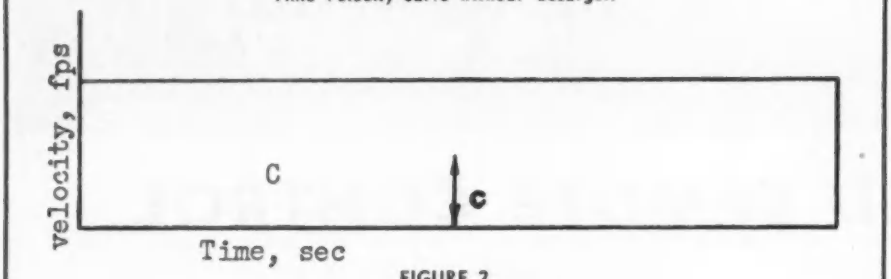


FIGURE 2
Time-Velocity curve with ideal desurger.

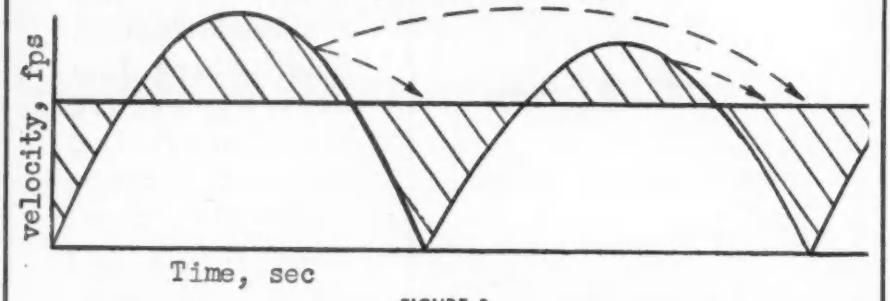


FIGURE 3
Time-velocity curve illustrating manner in which higher portions of curve fill lower portions to obtain ideal desurger curve.

How Pressure Surges Cut Pump Efficiency

Here's the result of controlled experiments using a 2½- x 3-inch reciprocating pump.

By JOHN HOWARD DAWSON
Associate Professor, Civil Engineering
Oklahoma Institute of Technology, Stillwater
and
ERNEST FITCH, JR.
The Carter Oil Company Research Laboratory, Tulsa

PRESSURE SURGES created by a reciprocating pump can not only damage pipe line equipment but also impair the operation of a pumping unit. And the effect of these pressure surges has been heightened by the changeover from steam to diesel-driven prime movers. The steam cylinder provided a cushion effect.

The trend in recent years has been toward the high-speed multicylinder pump because of the demand for greater capacity, higher pressures, higher speeds and a substantial decrease in pump weight per unit capacity. The larger the number of cylinders the smaller will be the surge. Most desurging equipment is not effective because of its inertia when operating frequencies are above 20 cycles per second. Cylinder pumps also present another source of trouble due to the tendency of waves to reflect in the pipe and thus build up high resonating pressures or standing waves. Since there are more cylinders there are more surges per revolution, thus, many more possible combinations or resonant frequencies.

The pressure surge comes from the sudden increase of velocity given to the fluid by the action of the piston. During the discharge stroke, the piston starts with a zero-forward velocity, increasing to a maximum at approximately midstroke, and decreasing to zero at the end of the stroke. The velocity curve for each piston of the pump would be the top half of a true sine curve if it were not for the variation produced by the angularity effect of the crankshaft on the piston rod. In order to have a nonpulsating flow from a piston pump, it is evident that an infinite number of cylinders would be necessary, spaced equally around the shaft.

The characteristics of the discharge line will materially affect the pressure variations in the flow line. For a short line, where the inertia of the fluid column is small and the pipe friction is negligible, the volume entering the line at the pump will be equal to the volume discharged at the end of the line at the same instant since the liquid is relatively incompressible.

In a long line, there is a compression of the liquid during the middle of the discharge stroke to the inertia of the fluid column and the pipe friction, which produces a pressure at

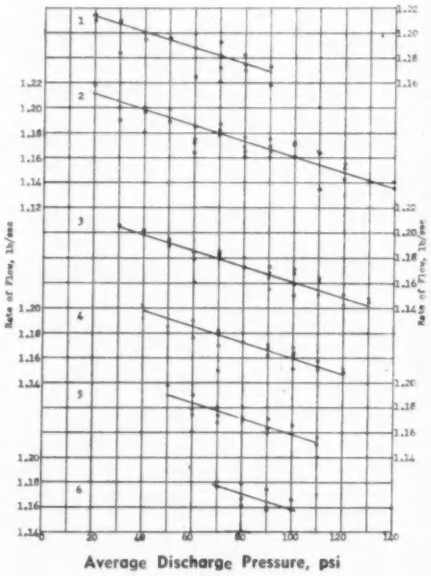
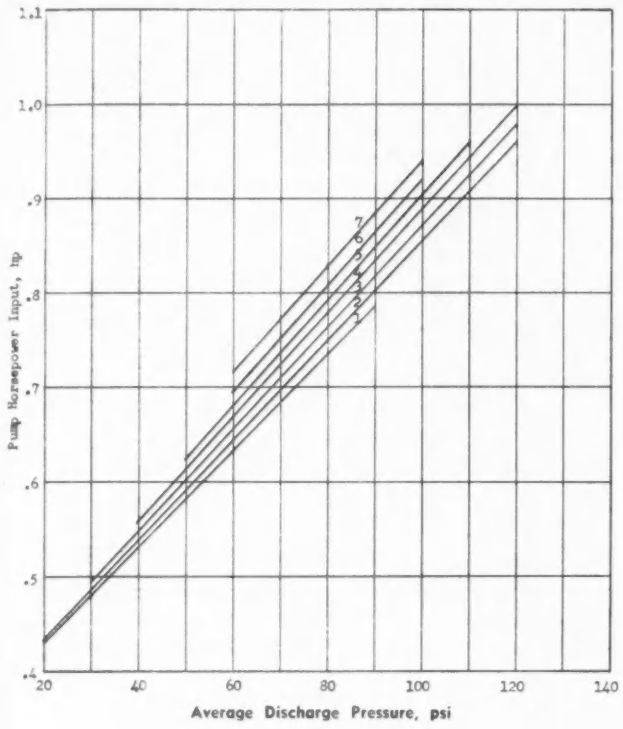


FIGURE 4
Rate of flow curve. Magnitude of flow for curve (1) 10 psi, (2) 20 psi, (3) 40 psi, (4) 60 psi, (5) 80 psi and (6) 100 psi.



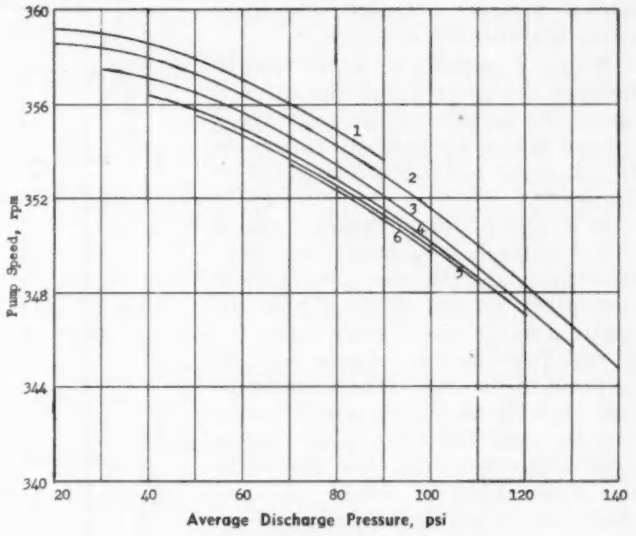


FIGURE 5 (above)

Average discharge pressure vs. pump speed. Magnitude of surge for curve (1) 10 psi, (2) 20 psi, (3) 40 psi, (4) 60 psi, (5) 80 psi and (6) 100 psi.

FIGURE 6 (left)

Average discharge pressure vs. pump horsepower input. Magnitude of surge for curve (1) 10 psi, (2) 20 psi, (3) 40 psi, (4) 60 psi, (5) 80 psi, (6) 100 psi and (7) 120 psi.

the start of the line in excess of the average discharge pressure. During the start and end of the discharge stroke, the pressure is lower than the average discharge pressure because the moving column attempts to "run away" from the pump. The pressure curve will hence show alternate increases and decreases of pressure at the pump end of the line in a periodic manner. The pressure surges will travel at sonic velocity through the fluid from one end of the pipe to the other.

The pulsations produced by a piston pump can be substantially reduced by installing a surge alleviator adjacent to the discharge end of the pump. The action of such equipment tends to even out the surge by absorbing the high pressure and filling in the gap on the resulting low-pressure portion. This equipment may be a simple air dome or a manufactured desurger.

The work that can theoretically be saved by attaching a desurger on the pump is accomplished by reducing the length of the fluid column that must be accelerated with each stroke. The only volume of fluid that is accelerated at each stroke will then be in the discharge line between the desurger and the pump.

Consider the ideal basic curves for a single-cylinder double-acting pump. Without a desurger attached, the velocity-time curve would be similar to Figure 1 which would approximate the pressure-time curve in the discharge line of the pump. The quantity-time curve for the pump will be the same as the velocity-time relationship shown in Figure 1 since the rate of flow from the piston is equal to the area of the piston multiplied by the velocity of the piston less any losses from leakage.

Part B of Figure 1 will not be as high as Part A because the piston rod will take up a portion of the volume normally filled with fluid. If the pump

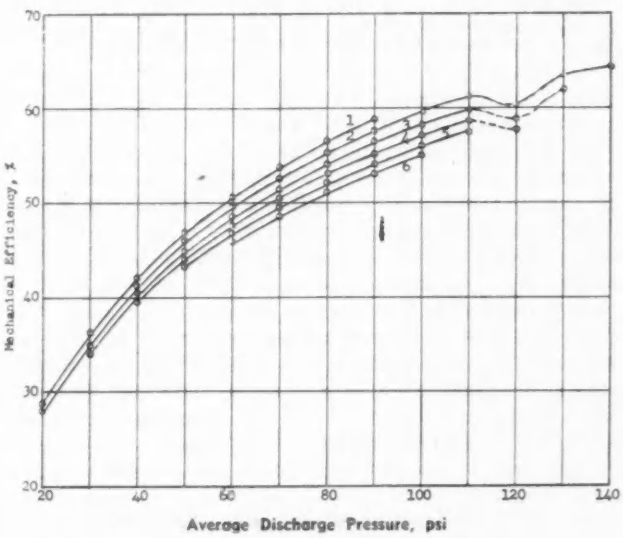


FIGURE 7

Average discharge pressure vs. mechanical efficiency. Magnitude of surge for curve (1) 10 psi, (2) 20 psi, (3) 40 psi, (4) 60 psi, (5) 80 psi and (6) 100 psi.

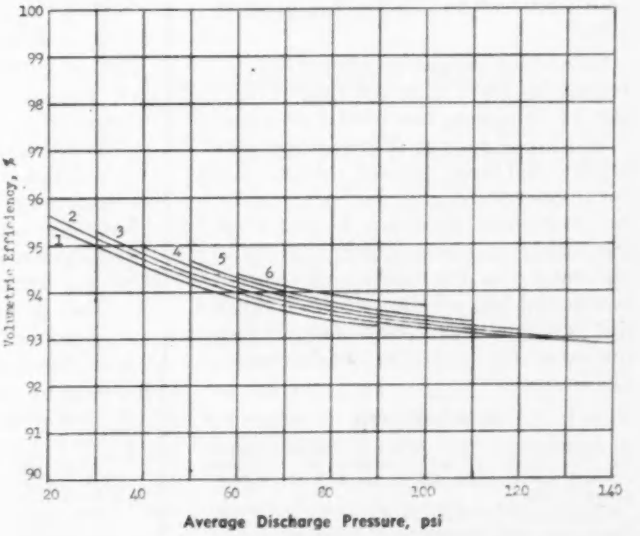


FIGURE 8

Average discharge pressure vs. volumetric efficiency. Magnitude of surge for curve (1) 10 psi, (2) 20 psi, (3) 40 psi, (4) 60 psi, (5) 80 psi and (6) 100 psi.

had a desurger attached, the ideal curve would resemble Figure 2.

Figure 2 appears as a rectangle because the portion of the curves above the average pressure of Figure 1 have moved horizontally and down to fill in the hollows as illustrated in Figure 3.

It is evident from Figures 1 and 2 that A multiplied by the distance from its centroid to the base plus area B multiplied by the distance from its centroid to the base is more than area C multiplied by the distance from its centroid to the base. This would indicate that less work is required to obtain the same discharge from a pump with a desurger than from one without a desurger. It should take less power to move a load constantly than is required to start and stop it endlessly, making it reasonable to expect better economy, smoother action and increased capacity from a given pump.

The surge on the suction side is due to the rapid deceleration of the fluid whereas on the discharge side it is due to the rapid acceleration of the fluid by the piston. Suction surges are dependent on the frequency, length of the suction pipe, and on the average and instantaneous velocity of the fluid. In the tests conducted for this investigation, the suction pressure and surge were maintained nearly constant by installing an airdome near the pump on the suction side and keeping the level constant in the suction tank. At the speeds at which the pump was tested, it is believed that the cylinder of the pump was full of fluid at each stroke. When the airdome was eliminated the pressure varied from + 25 pounds per square inch to —30 inches of mercury with every stroke of the pump. With the airdome the pressure went from —3 to —10 inches of mercury.

Secondary surges produced by reflecting surfaces play an important part in confusing the results obtained when testing pumps. These surges can be reflected from elbows, valves, various connections, and discharge tanks. In long lines they are a source of resonating pressures which may build up and cause the containing pipe to be stressed beyond the safe limit. Since this is a fluctuating load, fatigue failure may result in the weaker parts of the line.

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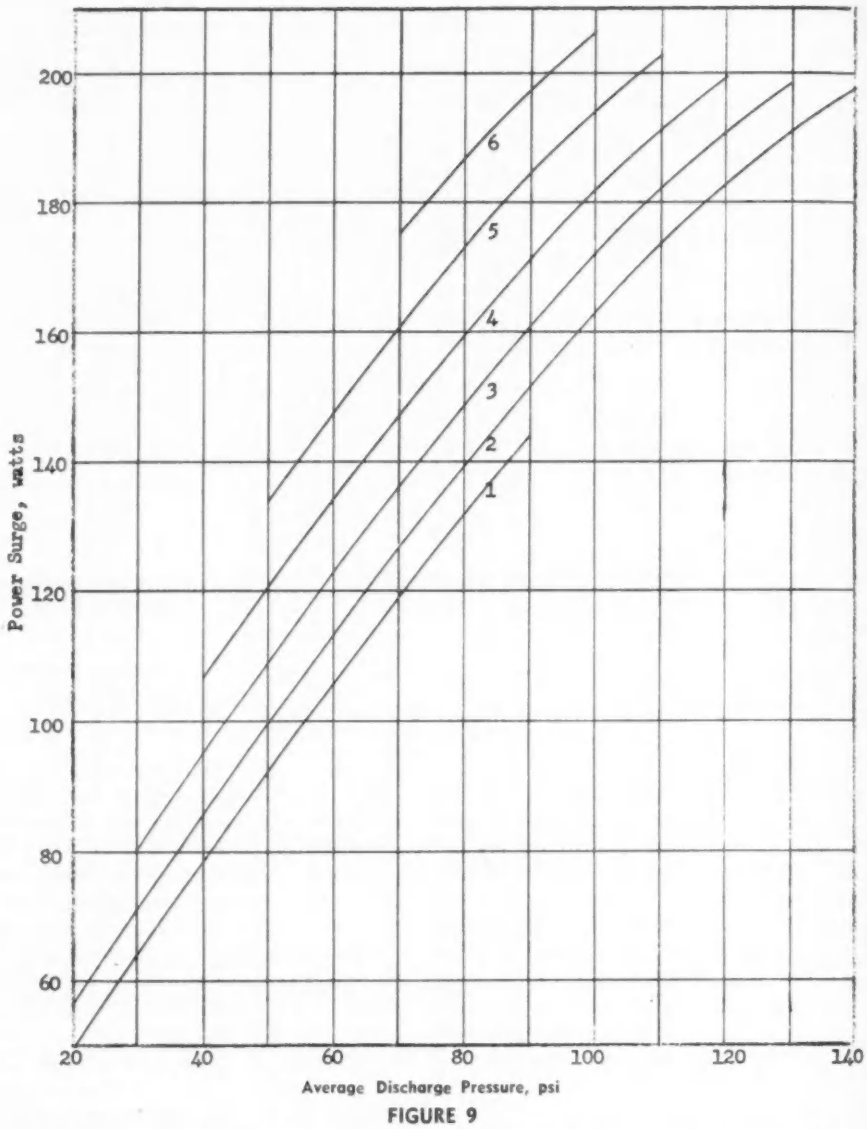


FIGURE 9

Average discharge pressure vs. power surge. Magnitude of surge for curve (1) 10 psi, (2) 20 psi, (3) 40 psi, (4) 60 psi, (5) 80 psi, and (6) 100 psi.

Coming in December . . . a new pipe line feature

A new feature for pipeliners who read WORLD OIL will start in the December issue and will run regularly thereafter. It will be known as "Rules of Thumb for the Pipeliner's Notebook" and will consist of easily used formulae, proven by practice, by which rapid calculations can be made.

While these Rules are published, generally speaking, for rough and rapid calculations, among them will be many so well based upon mathematical calculations that they can be used even in making a finished plan. Some have been so thoroughly based upon experience that they may be used just as they are presented in ordering materials. Generally, though, they will be offered for what they are called, "Rules of Thumb."

Two to three of these Rules will be presented each month.

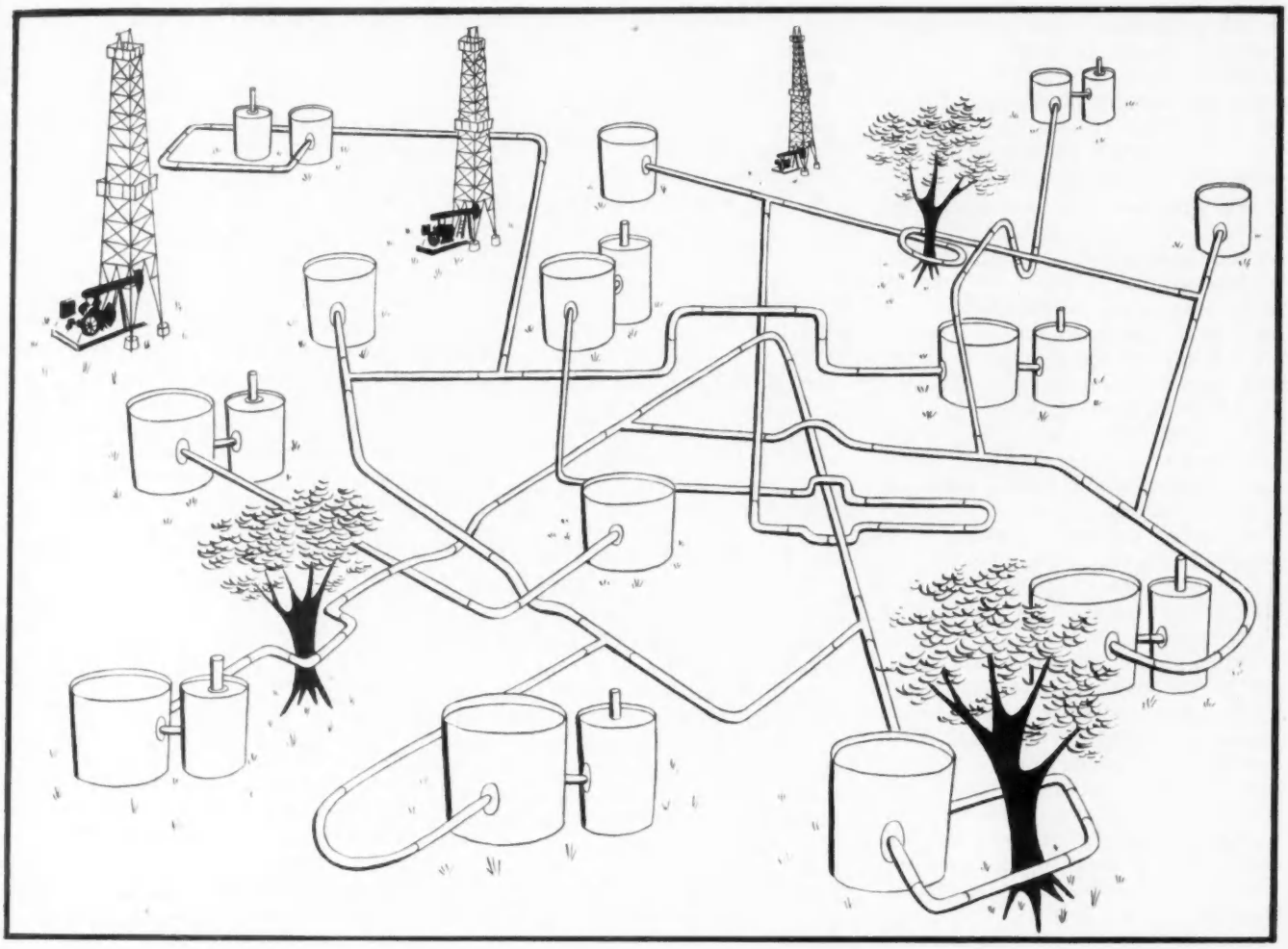
It is planned to give each Rule a symbol and a number by which if a pipeliner wishes to clip the page and paste it into looseleaf notebooks, the "Rules" may be arranged by classification and in such manner as to make it possible to be indexed easily.

Once a year WORLD OIL will publish an index to these Rules.

It is planned after this feature has been published for sometime, to republish the material in book form.

The Rules are coming from engineers and executives who are being contacted by Don Taylor, Pipe Line Editor of WORLD OIL.

This feature will start with the December issue. Look for "Rules of Thumb for the Pipeliner's Notebook."



'. . . . . most gathering systems just grew . . .'

What You Should Know When Planning A Gathering System

Planning will avoid trouble in needless fuel costs, excess maintenance, heavy repair expenditures

By C. O. NIELSON
Service Pipe Line Company, Wichita, Kansas

LIKE TOPSY, most gathering systems just grew. In the feverish excitement which follows discovery of a new oil field, gathering system planning and design is often haphazard. Speed of connection is the dominant factor. Often the net result is a system which will require needless fuel cost, maintenance, repairs and replacement for years to come.

Most of these troubles could be avoided by proper planning.

Here are important factors which should be considered before the gathering system is laid:

Limits of the Field—The limits of the pool may be an unknown factor at the time a line is laid into a new area. However, the field engineer should gather all information possible which will give an indication of these bounds. Some pipe line companies employ geologists. From available geological data, the possible limits of the pool can be determined. When this information is not available, considerable data can be obtained in the field. The producers are very cooperative in furnishing data in regard to wells. Facts should be obtained with regard to formation elevations, results of production tests, allowables and dry holes. Dry holes may be assumed as a boundary and evaluation of the other data should indicate the direction in which the pool is apt to expand and possible limits of the pool.

Lease Information—In laying out a new gathering system, the engineer must have a detailed working map showing wells, leases, drainage and probable pool outline. The approximate tank battery sites can be located

on the individual leases in the probable pool area. In most cases, the producer finds it desirable to construct the battery near the center of the lease. Plans should be made as to how these possible batteries would be connected into the system.

Topography—It is impossible to lay out an efficient gathering system without giving due consideration to the topography of the pool area. A plane table is by far the best instrument to use in making a topographic map. If topography maps were available for all gathering areas, wide use would be made of them by the field and general office. Too often a gathering system is extended by the piecemeal method, making connections by the cheapest original cost method and then ending up being extremely expensive to operate. The availability of this map to all concerned would be a big factor in eliminating this type of construction.

When many thousands of dollars are to be spent in constructing a gathering system, a nominal fee should be spent for a plane table survey. The plane table operator should look the area over before the survey is started and decide what information is needed on the map. This should include shots for elevation and location of drainage area crests and shots in the low points of the drainage area for elevation and location.

All existing tank batteries should be located and tank bottom elevations determined. Numerous other things should also be located in this survey such as section corners, buildings, producing oil wells, dry holes, timber, rock cliffs and any other physical characteristics which would have bearing on pipe line location. Some areas of the country are so flat there appears to be no drainage pattern. But the cases will be rare where there is not a drainage pattern of some type. A very satisfactory survey can be made using a transit and stadia board. However this method takes time and is expensive.

Aerial maps give an abundance of information. They have been used extensively in making discharge line surveys and have proven very satisfactory.

Crude Oil Analysis—Knowing the physical characteristics of the oil is essential for optimum sizing of lines and pumping equipment. There have been cases where batteries have been connected and the discovery then made that the characteristics of the oil were such that the oil could not be transported through their lines. Such poor planning results in unnecessary expense. There are an increasing number of cases where low gravity and high viscosity crudes are being moved by pipe line with transportation costs in excess of the tariff received. These problems will require considerable research in order to overcome operations which result in uneconomical movements.

Laying Out Gathering Lines—There are two important factors with regard to volumes which must be kept in mind when laying out a gathering system. First, there is apt to be a period of expansion and flush production until the peak is reached. Second, there will be a period of decline from the peak to the time the field is abandoned. The basic problem involved is to try to lay out a gathering system which will be economical throughout the life of the pool.

The Ideal Gathering System

From an operating standpoint the most economical system is similar to a river with tributaries, all flowing by gravity to a common point. In this case there will need to be only one pumping unit in the system for transferring oil from the gathering system into the trunk line. At this unit, an automatic air bleeder should be installed since pumps often become filled with air and run a considerable time without pumping oil. Air is normally thought of as being cheap but in a gathering field it can become very expensive.

Shutoff valves should be installed at each battery so that the flow of oil from the batteries will be cut off before air can enter the pipe line.

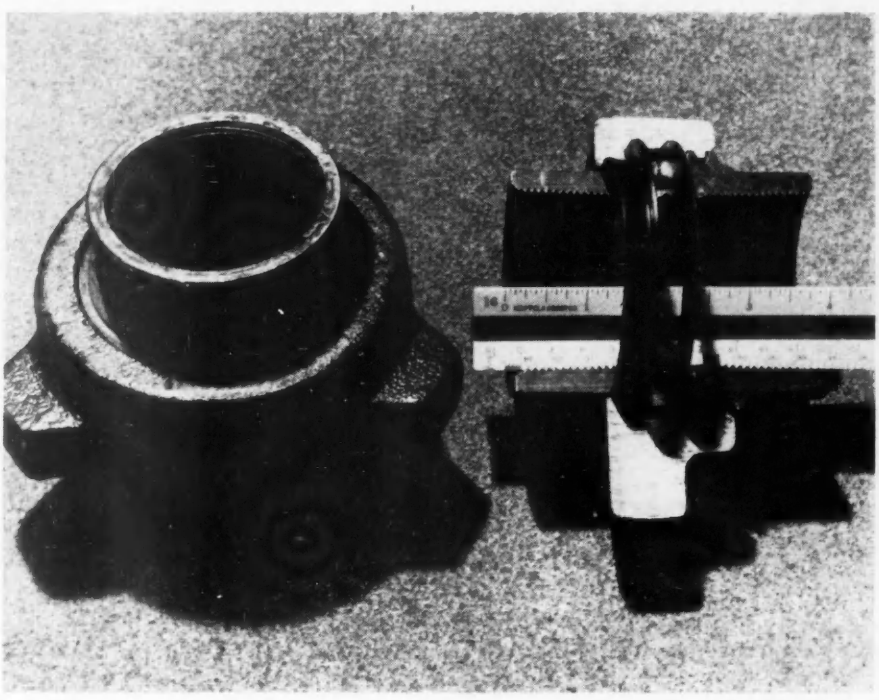
Check valves should be installed on battery lines where there is any chance of oil backing up from another battery and flowing over the tanks. Some companies make a practice of initially installing a check valve on each battery line. This is a good practice since it might eliminate the necessity of coming back later and installing one at a much higher cost. This would be necessary if a higher battery was connected or a pump set which would pump into the gravity lines. Installations should be made so scrapers can be run through all lines. Here again, if put in at the time of the original installation, the cost will be minor. Every effort should be made to keep the capacity of the lines up to full rating. Why have the investment in a four-inch line and the capacity equal only to a three-inch? Lock stops should be installed on all tributary lines at the junction with the main stream. If a battery is abandoned and the battery line is to be removed, you will not disrupt the movement of oil through the main line.

It is becoming common practice to keep the tank header, connecting the different tanks of a battery, above ground. By keeping this tank header up corrosion can be kept to a minimum, fewer fittings will be used and it will also be much easier to connect any additional tanks which may be set. As the field is extended and additional batteries are connected, the line to the farthest battery should be connected so it will become the main line. This will necessitate the cutting of previously laid line and tying into the side of the new one.

If a map has been made of the area, all lines will be laid out on this before the actual staking and grading of the lines. These will be approximate locations and it will still be up to the engineer to see that the best location is selected. One of the most common mistakes is to locate a line at too high an elevation when it could have been located lower with a small amount of additional pipe. When this happens, the next extension will require the installation of a pumping unit or an unnecessary amount of additional pipe.

In staking gravity lines, it should be kept in mind that the prime interest is grade and not alignment. High points in the grade line are conducive to the trapping of air which will retard the flow of oil. A gradient with a continuous fall is desirable. In order to eliminate excessive cuts, the line is apt to be crooked and the tangents short. However, most gravity lines are laid with small size pipe which is easy to bend. Although poor practice, many gravity lines are staked without the use of a transit. The more experience the engineer has in staking gravity lines, the less he will use the transit. After setting markers at the points of intersection, visually line in the intermediate markers or set two markers on the tangent and produce the line to the next PI.

Time can be saved and errors eliminated by plotting the profile and laying the grade while in the field. The cuts or fills can then be marked on the stakes and it will not be necessary to make a return trip. Before sizing the lines, an estimate should be made of the probable amount of oil to be moved. Information is available for the producing wells which will give an indication of what should be expected in extensions. It is obvious the gravity line can go only to the limits of the drainage area, beyond which production that is connected will have to be pumped. With all of the above mentioned information at hand, the line size can be determined by hydraulic calculations.



At right is a center-cut section of high-pressure insulated union. Approximately four inches long, union is sealed with two "O" rings in addition to insulating gaskets between faces of union and around base of hammer lug section.

New Insulating Union for Corrosion Control

From ¼ inch to 10 inches, this device will break up the flow of electrolytic current from tubing and casing in oil, gas wells.

By K. B. SHEARON
Corrosion Engineer, Brance-Krachy Company, Inc., Houston

A HIGH-PRESSURE insulating union provides an economical means of breaking up the flow of electrolytic current from christmas tree to pipe line system. It was developed in recent months and has passed detailed laboratory tests and analyses.

This insulating union employs the "O" ring principle of high-pressure sealing, with insulating gaskets between the faces of the union and around the base of the hammer lug section.

The unions are obtainable in sizes ¼-inch to 10 inches and from 1000 pounds test pressure to 6000 pounds test pressure.

At the laboratory, a 2000-pound hydrostatic test was conducted on a 2-inch steel union, with the pipe connection designed to be tightened and released by hammer blows on projecting segments. The hydrostatic test was held for 20 minutes, and no evidence of leakage appeared.

After the hydrostatic test, the 2-inch union was disassembled and reassembled with a 1½-pound machine shop hammer 200 consecutive times to determine the damage, if any, to the 1/16-inch by 3⅜-inch outside diameter gasket. An examination was made each 15th time during this series of tests.

After 120 cycles, a circular indentation of .015-inch in maximum depth on about 90 percent of the gasket face was evident. At the 150th assembly, the .015-inch indentation about 5/32-inch wide completely surrounded the gasket face. At the 200th assembly, the gasket showed surface indentations due to contact with the metal surfaces, and minor upset near the edges from compression loads was evident.

Following the final assembly, a hydrostatic test was reapplied and held for 40 minutes. No leakage occurred.

An electrical conductivity test on the assembled union showed no current flow across the union, indicating that the design offers complete electrical insulation in the union.

1 Pickup truck, carrying bundle of 16 20-foot joints on side racks, easily handles stringing job. Two men string pipe and easily keep pace with slow-moving truck.

2 Here's a demonstration of how one man can handle 100 feet of the plastic pipe—a total weight of 88 pounds.

Lightweight Plastic Pipe . . . .

3 First operation in joining pipe sections is "painting" of both ends with special solvent. Exterior of male section and interior surface of belled section are given two coats, one immediately after other.

4 When two ends are thrust together, one section is given quick quarter-turn to drive joint home. Joint is held firmly for few seconds while solvent sets up. The joint is then securely and permanently welded together.

. . . . Is Meeting Specialized Needs

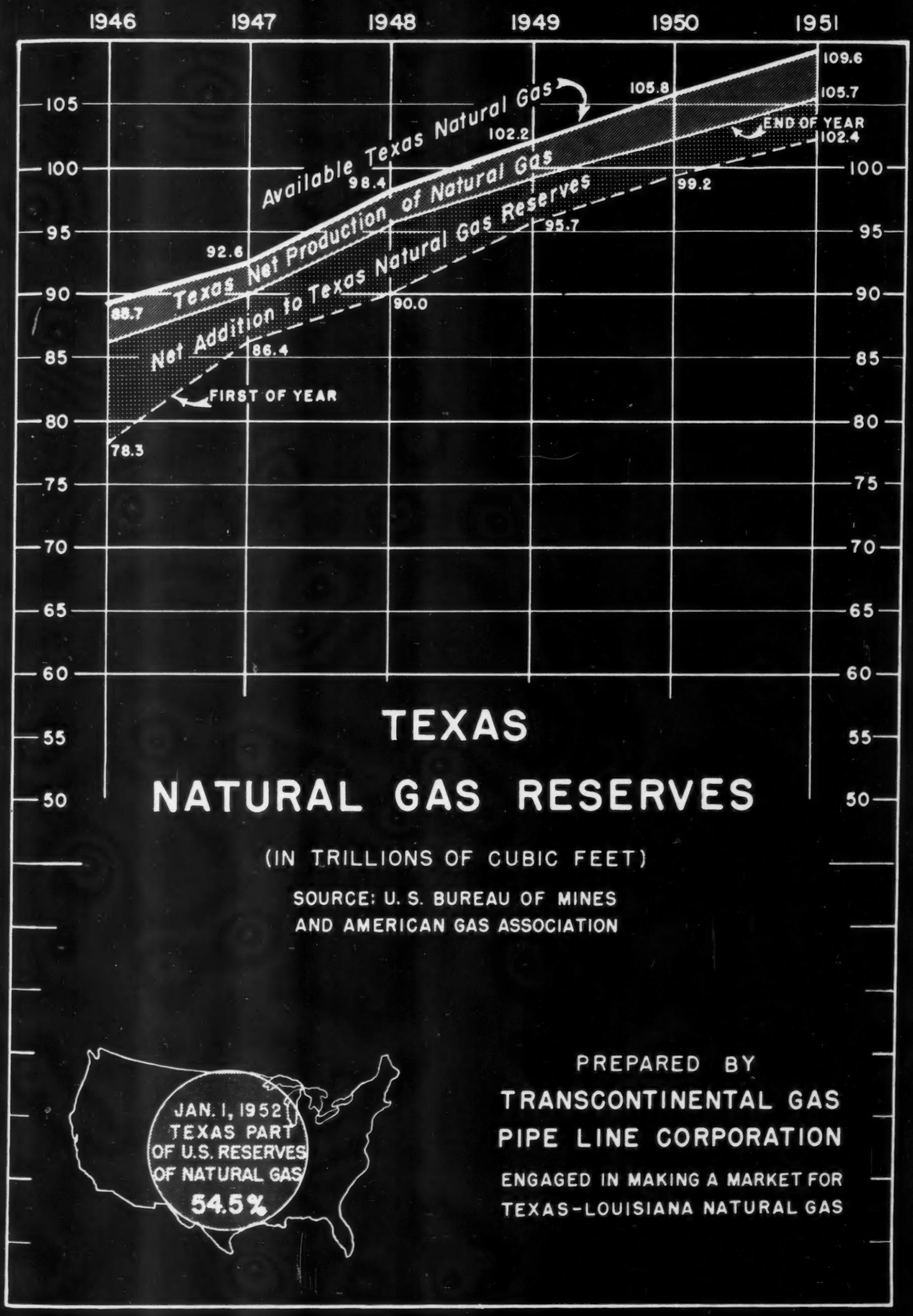
California job points up some advantages . . . it's easy to transport and easier to lay.

By GILBERT M. WILSON
WORLD OIL Staff

ONE OF THE first large-scale applications of plastic pipe to the California oil industry was the recent laying of some 4000 feet of 2- and 3-inch clear transparent plastic pipe in the Rio Bravo field of San Joaquin Valley. It was laid in a matter of several hours. The line consisted of 1600 feet of three-inch and 2400 feet of 2-inch, the latter including about 400 feet that was pushed through an existing old and corroded steel pipe line that eliminated having to dig a ditch inside the yard of the cycling plant in the Rio Bravo field.

Numerous advantages result from the use of plastic pipe in certain applications found in oil field installations. Among the most important of these are its ease of transporting to the job, the speed that is possible in connecting joints and laying the line in the ditch, its inertness to rust or corrosion, and, being made of a non-conducting material, its ability to withstand electrolysis. Being flexible, the pipe can be strung in ditches whose bottoms do not have to be smooth; can be laid in a curve to go around obstacles or turn corners of moderate radius.

On the particular job mentioned above, these features were effectively demonstrated. The job consisted of


1946
1947
1948
1949
1950
1951
105
100
95
90
85
80
75
70
65
60
55
50
Available Texas Natural Gas
Texas Net Production of Natural Gas
Net Addition to Texas Natural Gas Reserves
88.7
92.6
98.4
102.2
105.8
109.6
86.4
90.0
95.7
99.2
105.7
102.4
78.3
FIRST OF YEAR
END OF YEAR
TEXAS
NATURAL GAS RESERVES
(IN TRILLIONS OF CUBIC FEET)
SOURCE: U. S. BUREAU OF MINES
AND AMERICAN GAS ASSOCIATION
JAN. 1, 1952
TEXAS PART
OF U.S. RESERVES
OF NATURAL GAS
54.5%
PREPARED BY
TRANSCONTINENTAL GAS
PIPE LINE CORPORATION
ENGAGED IN MAKING A MARKET FOR
TEXAS-LOUISIANA NATURAL GAS

stringing a fresh water line to replace an old three-inch steel pipe line that was laid in 1937 and in the intervening years had become badly corroded and had developed numerous leaks. That far less expense was incurred in digging the ditch was demonstrated when the company found it was unable to arrange for a conventional ditch digging machine because at the particular time, all available machines were busy replacing or repairing water lines, irrigation lines, etc. in other parts of the Valley, repairing damage done by the July 21 earthquake. Last minute arrangements, however, brought forth a road grading machine which was pressed into service to cut the ditch. By using the corner of the blade, and making three passes over the right-of-way, a very serviceable V-shaped ditch was made. From 18 to 24 inches of cover was provided which was ample for the protection of the pipe, and at an estimated cost of from one-fourth to one-half of what it would have cost to cut a conventional square-bottom ditch.

Lightweight, Clear Plastic

The plastic pipe, of a clear, transparent material known technically as cellulose acetate butyrate, was brought out to the field in bundles of 16 20-foot joints, one end of each joint being factory belled to a very close tolerance which, when jointed, provides a strong, leak-proof joint. On the present job, a light pickup truck was used, (Figure 1) the bundle of 16 joints being laid on pipe racks on the side of the unit. With the pickup moving along at a slow speed and without stopping, two men easily strung a bundle of 320 feet of pipe in a matter of only several minutes. A two-man "spread," working without equipment other than a can of solvent and a brush, then connected up the pipe and laid it in the ditch.

Connecting and laying the pipe was done rapidly, the average laying time being at the rate of about one joint a minute, including cementing, laying the pipe in the ditch and moving on to the next joint.

Connecting a joint consists of first "painting" the outer surface of the male end and inner surface of the belled end with the plastic solvent (Figure 3). This is repeated immediately afterward and the two ends then are thrust together. As the joints are driven together, (Figure 4) one is given a quarter turn to facilitate driving it in smoothly and snugly. The joined sections are held together firmly for a few seconds while the solvent sets up. On setting up, the joint then is laid on the ground and the crew proceeds to the next joint.

5 Shoving new plastic pipe through corroded or abandoned line is practice being adopted by some users. Lower hydraulic friction of plastic pipe permits use of smaller diameter line and running smaller line.

Inexperienced hands, after making up only several joints, under proper instruction and supervision, easily become experienced and can be allowed to continue by themselves. An improperly made-up joint readily is detected, for a holiday, if any, easily is seen in the film bonding the joints together. However, even when a holiday is noted it need not be considered an imperfect joint if not less than ½-inch of fully sealed surface of the joint is sealed together.

New Line Pushed Through Old

Demonstrating one of the practices being used with plastic pipe, one that is becoming increasingly popular on problem lines where ditching is expensive or impractical, some 400 feet of the two-inch tubing was run inside a section of the old three-inch line. This particular section was inside the fenced enclosure surrounding the cycling plant and, to dig a ditch to lay the pipe in the conventional manner, would have meant the moving in of ditching equipment, use of considerable hand labor to dig out beneath fences, preparing culverts and otherwise disrupting traffic and operations within the plant area.

Pushing the new line inside the old service (Figure 5) required only the digging of a bell hole inside the plant area at the point where the new line was to joint the main supply line. At the other end of the 400-foot section of old line, outside the plant fence, the plastic pipe was made up in long sections and pushed through the old steel line, the only precaution taken being the bull-plugging of the forward end of the plastic tubing in order to prevent scooping up of debris and to help guide it through rough or scaled areas. The time and effort saved on that short section of the line alone probably would have made the use of plastic pipe well worth while.

Although the 400-foot section of two-inch pipe was of smaller I.D. than that of the previous line, there was little or no loss of flow for the plastic pipe, being virtually frictionless, as compared with conventional pipe, has, for a given size pipe, a flow capacity ranging from 18 to 25 percent greater than that of steel pipe. It therefore is feasible to use smaller sizes of pipe to obtain the same through-put whether the line is used for liquids or gas.

Table 1 shows weights, bursting pressures, general properties and chemical resistance of the six principal grades of the particular make of pipe used on this job. It will be seen, for example, that weight of two-inch plastic pipe used on this job is only 45 pounds per 100 feet and is light enough to permit a man to carry 100 or more feet of the pipe without assistance. Actually, the five 20-foot joints shouldered by the man in Figure 2 is three-inch size, having a weight of 88 pounds per 100 feet.

Working pressure of the two-inch pipe used on this job was 125 pounds per square inch, but this rating carries with it a safety factor of four, so there was no question of the ability of the pipe to withstand a wide range of pressures likely to be put on the line.

Corroded Line Replaced

In a previous application of this type of pipe to the oil industry, an operator in the Long Beach area found it necessary to replace an old combination 3- and 4-inch steel water disposal line. Some 660 feet long, the line had been giving considerable trouble with leaks caused by extensive corrosion and it finally was necessary to replace it. Ordinarily, with steel pipe, the job would have required the digging up of the old line and replacing it with new, welded or thread-and-collar pipe. However, even then it ultimately would have had to be replaced due to the corrosion problems existing in the area.

Using the plastic pipe, the operator was able to open a bell hole at each end of the old line and push through the 660-foot string of the two-inch plastic tubing, an operation that required a matter of only about two

hours. At one point in the operation, with 200 feet of the new pipe already inside the old line, an obstruction was encountered which prevented further passage of the plastic pipe. The problem was overcome quickly, however, by plugging the tubing and filling the old line with water.

This floated the new line and enabled workmen to shove it past the obstruction. From that point on no further trouble was experienced. The new line, in the several months that it has been in service, has given excellent results. Flow through the smaller line is adequate inasmuch as the skin friction of the tubing is so much less than that of conventional steel pipe.

That the material can withstand very cold climates is demonstrated by the fact that a number of successful installations of plastic pipe have been made in the Williston Basin and certain Rocky Mountain fields. In the Glendive, Montana, end of the Williston Basin, one company recently installed 4100 feet of two-inch pipe as a salt water disposal line. This line, operating at about 60 psi, is buried four feet underground; about two feet below the average frost line.

In two central Wyoming fields, at least two operators have turned to plastic tubing to help solve salt water disposal problems. In one field, two installations of three-inch plastic pipe, one of 1500 feet and another of 2000 feet, were made for this service. In another field, a 5000-foot salt water disposal line, of two-inch plastic pipe, recently was laid.

A major company, in what is believed to be the first action of its kind in the oil industry, only recently approved, for all of its divisions in the United States, the use of this type of pipe for fresh water, salt water lines and gathering lines.

Gas utilities, also, are finding that plastic pipe fills certain of their requirements, particularly in the ½-inch service lines used for connecting residences with gas mains. In this service, the pipe is purchased in 200-foot coils and carried to the field where desired lengths are cut off and, with special adapters, connected into conventional steel fittings at either end of the service line.

Cost of plastic pipe, while slightly higher in the initial outlay, actually is being gradually reduced as manufacturing facilities are increased and plastic ingredients become more plentiful. Although slightly higher, initially the slight differential in price between it and steel pipe of comparable sizes, is said to be more than made up by the reduced cost of transporting, laying and maintenance, particularly when it is employed in a service where, because of corrosion or other factors, entire lines otherwise would have to be replaced, or at least extensively repaired at frequent intervals.

The plastic pipe referred to in the above-described installations is available in all sizes ranging from ½-inch up to and including five-inch. Equipment shortly is to be installed permitting manufacture of six-inch and larger sizes and, in the near future, it is expected that equipment capable of turning out 12-inch plastic pipe will be installed. A wide range of fittings, including elbows, tees, reducers, unions, sleeve couplings and special steel-to-plastic adapters, is available for each size of pipe. The plastic pipe, along with a wide range of couplings and fittings, currently is being stocked by two large oil field supply companies, one in the Mid-Continent area and one in California.

ACKNOWLEDGMENT

The author acknowledges with thanks data supplied by Robert Raab, Golden Bear Manufacturing Company, Los Angeles.

TABLE I

Weight Chart in Lbs. Per 100 Feet

TYPES IPS	O.D.	I.D.	P	S	O	A	D	W
¾″	1.050	.926	7.4	8.5	9.7	9.0	11.3	8.5
1″	1.315	1.135	13.5	15.6	17.8	16.5	20.7	15.6
1¼″	1.660	1.410	22.8	26.4	30	18.8	35.0	26.4
1½″	1.900	1.650	26.6	30.8	35	32.5	40.8	30.8
2″	2.375	2 125	34.2	39.6	45	41.7	52.4	39.6
2½″	2.875	2.543	54.0	62.4	71	65.9	82.8	62.4
3″	3.500	3.168	68.0	77.4	88	81.6	102.6	77.4
4″	4.500	4.084	108.0	125.0	142	131.7	165.6	125.0
5″	5.563	5.147	135.4	156.6	178	165.2	207.5	156.6

Burst Pressures in Lbs. Per Sq. Inch

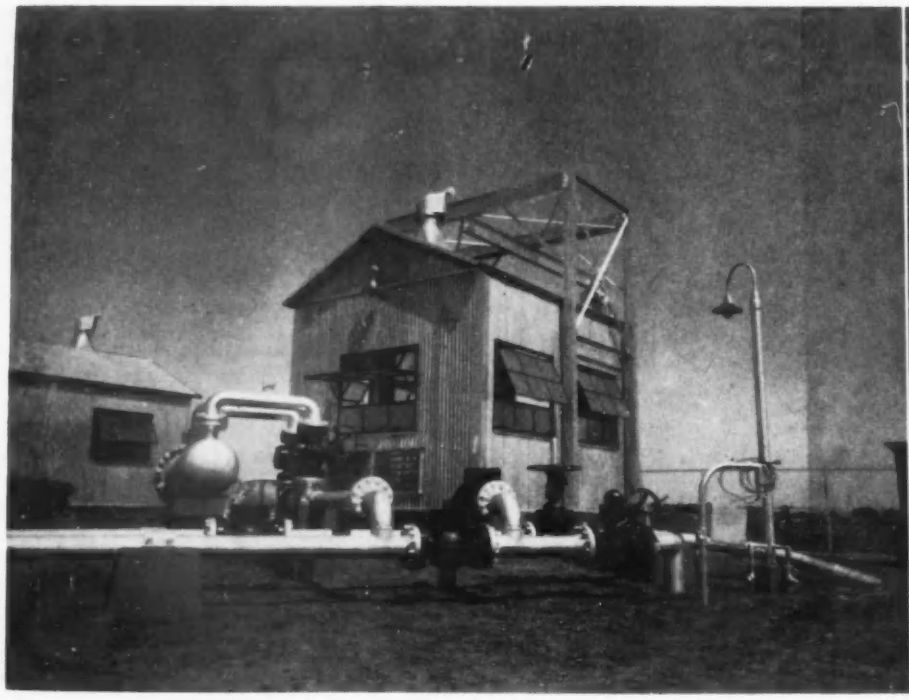
¾″	....	....	153	1200	590	826	1071	560
1″	....	....	176	1400	730	952	1224	690
1¼″	....	....	195	1550	800	1050	1350	740
1½″	....	....	170	1350	655	917	1179	605
2″	....	....	136	1100	525	735	945	505
2½″	....	....	149	1200	575	805	1035	535
3″	....	....	122	970	500	658	846	460
4″	....	....	119	950	460	644	828	425
5″	....	....	97	750	375	525	675	350

General Properties

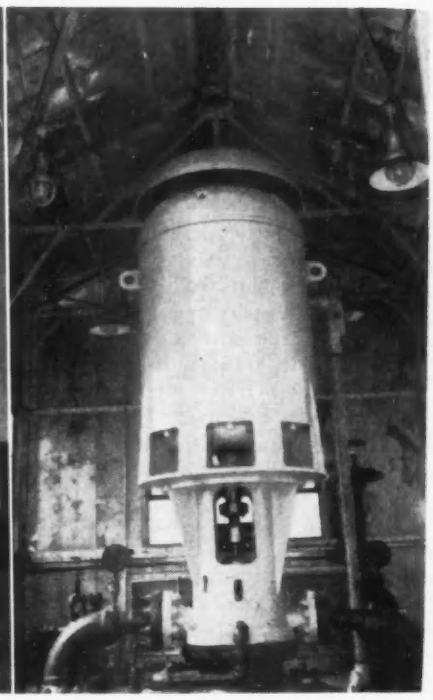
Tensile Strength (Ultimate) Psi.	1,300	10,500	5,400	7,000	9,000	5,000
Elongation at Ultimate Tensile	200	3	40	5	6	1.5
Heat Distortion Point, °F	170	210	180	150	190	170
Impact Izod Ft. Lbs., 66° F	>16	2.1	1.	4	3	11.5
Clarity	Translucent to Opaque	Translucent to Opaque	Transparent Translucent Opaque	Transparent Translucent Opaque	Transparent to Opaque	88-92% Light Transmission
Dielectric Strength Volts/Mil	480	460	450	400	700	700

Chemical Resistance

Soap Solution	No Effect	No Effect	No Effect	No Effect	No Effect	No Effect
Glycerin	No Effect	No Effect	No Effect	No Effect	No Effect	No Effect
Turpentine	No Effect	No Effect	No Effect	No Effect	No Effect	No Effect
Gasoline—Under 100 Octane	No Effect	No Effect	No Effect	No Effect	No Effect	No Effect
Sour Crude Oil	No Effect	No Effect	No Effect	No Effect	No Effect	No Effect
Ethyl Alcohol	No Effect	Slight Etch after 1400 Hours	Softens	Slight Softening	No Effect	Attacked
Isopropyl Alcohol	No Effect	Slight Etch after 1400 Hours	Softens	Slight Softening	No Effect	Attacked
Strong Acids	No Effect	No Effect	Decomposes	Decomposes	No Effect	Attacked
Weak Acids	No Effect	No Effect	Slight Attack	Slight Attack	No Effect	Slight Attack
Strong Alkali	No Effect	No Effect	Decomposes	Slight Attack	No Effect	No Effect
Weak Alkali	No Effect	No Effect	Slight Attack	No Effect	No Effect	No Effect



Booster pump station at Abilene, Kansas. Remote control is housed in building at left. Pump is in center building.



Vertical pump at Tecumseh, Neb., station.

Teletype Controls Provide Efficiency and Convenience

Here's the outstanding feature of a modernization program that has increased capacity of NCRA line.

By C. H. HOHNADEL
Refining Engineering Company, Tulsa

A MODERNIZATION program which has increased the capacity of the National Cooperative Refinery Association's products pipe line between McPherson, Kansas, and Council Bluffs, Iowa, has just been completed.

The outstanding feature of the new installation is strict semi-automatic line and communications control along the entire system. It utilizes teletype control, telemetering and communications equipment which provide top efficiency and ease of operation.

The line capacity has been increased from 12,000 barrels to 17,000 barrels per day following installation of two booster pump stations at Abilene, Kansas, and Tecumseh, Neb. The stations have two 20-stage, vertical hydropress pumps driven by 300 horsepower, 3590 revolutions per minute, 2300-volt vertical hydropress, explosion-proof electric motors. Equipment is housed in steel frame buildings of most modern design.

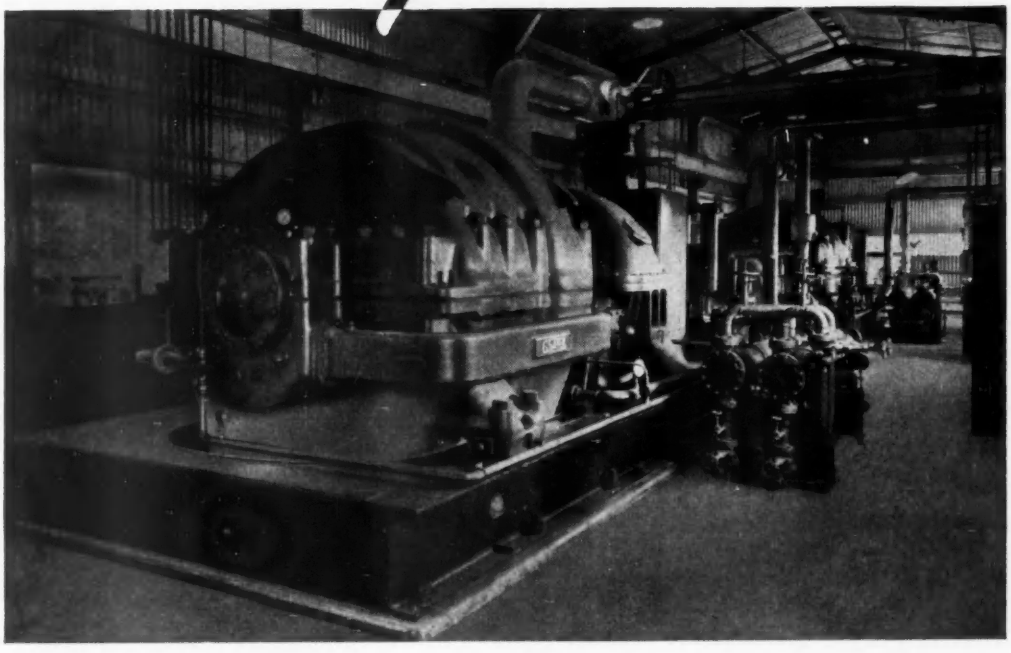
The entire system is controlled from a dispatcher's office at McPherson. The main teletype control, as well as the control panel of the McPherson station, is located in this building which is of steel-frame, well lighted, insulated, and so located as to give the dispatcher an unobstructed view of the station and surrounding area.

The first booster station at Abilene has two buildings; a control building and a pumphouse. The control building has a prefabricated steel frame, and corrugated iron siding. It houses the control panel, telephone panel, teletype and air compressor. It is electrically heated and thermostatically controlled to maintain a minimum temperature of 40 degrees regardless of outside temperature. The pumphouse is of similar construction and so arranged that the pump can be removed by a five-ton chain hoist. It has a removable ridge and end panel to allow for easy removal of pump and motor.

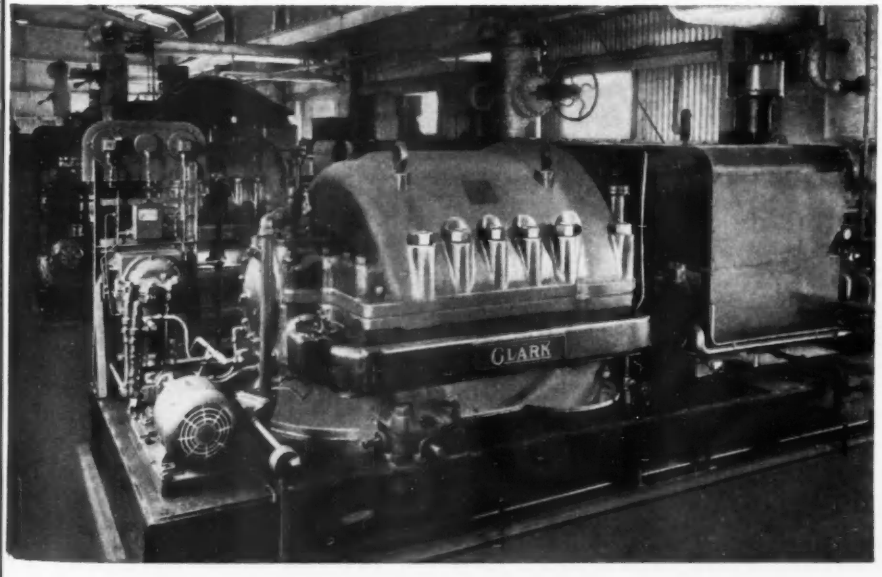
The pumps are of the vertical double case, double volute type, containing 20 stages for the ultimate conditions. They are destaged to 18 stages for the initial conditions. By destaging, the efficiencies at all capacities remain unchanged while the head is reduced in the factor of 20 to 18.

STATION CONTROL. Stations can be started by automatic control. The starting can be initiated locally or remotely by teletype, depending on position of the control switch. The first step in the starting sequence takes place when the suction valve relay is energized and the suction valve is opened. When this valve is wide open, the motor starting contactor is closed

cat cracker centrifugal compressors ...exclusively



Two Clark No. 5 Multi-Stage Centrifugal Compressors, steam turbine driven, serving as main air compressors for Gulf Oil Corporation's Port Arthur, Tex., cat cracker.



Two No. 3 and one No. 2 Clark Multi-Stage Centrifugal Compressors are used in vapor recovery and propane refrigeration service, respectively.

© 1952, Clark Bros. Co., Division of Dresser Operations, Inc.

Control valve at Abilene station.

Teletype machine at main control station in McPherson, Kansas.

and reduced voltage supplied to the motor terminals. After a preset time delay, the motor run contactor is closed feeding 2300 volts to the motor.

When the starting contactor is closed, the discharge valve timing relays are energized. These relays determine the initial point when the discharge valve opening is started and then in 12 preset steps control the opening of the discharge valve. This timing relay with 12-step operation is adjustable for a maximum of five minutes total interval, this then completes the starting sequence.

Normally the station is shut down by the opening of a teletype contact or by the operation of the stop push-button, depending on the set position of the control transfer switch. This opens the master relay which shuts down the pump motor and also acts to close the suction and discharge valves. The station may also be shut down by any of the protective devices with which it is equipped.

STATION STARTING. In order to start the station automatically:

- The discharge valve must be closed.
- Timers for opening the discharge valve must be set.
- Conditions must be in normal operation and none of the protective devices in an operative position.

With the above conditions and with the control transfer switch in its "remote" position, the station may be started by the closing of the teletype contact. This contact is actuated from a remote control point (McPherson, Kansas) by a teletype signal. This contact picks up a panel relay which energizes the master relay when all the starting conditions are met. The station may also be started locally at the station panel by turning the control transfer switch from "remote" to "manual" position and pushing the start button.

STATION SHUTDOWN. The station is shutdown during normal operation by the opening of the remote control contact by teletype, which de-energizes a relay which in turn opens the master relay. If the station is operating with the control transfer switch in the manual position, it may be shut down by pushing the stop button which de-energizes the master relay. Contacts open to de-energize the starting contactor and the run contactor which remove the pump motor from the line, at the same time contacts close to energize the close coils of the suction and discharge valve motor starters.

PROTECTIVE DEVICES. There are two trouble contacts used for each permanent protective functions; the normally open contact is used to energize its respective annunciator coil which trips and indicates the cause of the shutdown by use of a numbered flag. Corresponding numbers are given each permanent function as follows:

1. Pump discharge temperature.
2. Pump gland temperature.
3. Pump case pressure.
4. Seal leakage.
5. Motor stator temperature.
6. Motor bearing temperature No. 1.
7. Motor bearing temperature No. 2.
8. Pump bearing temperature.

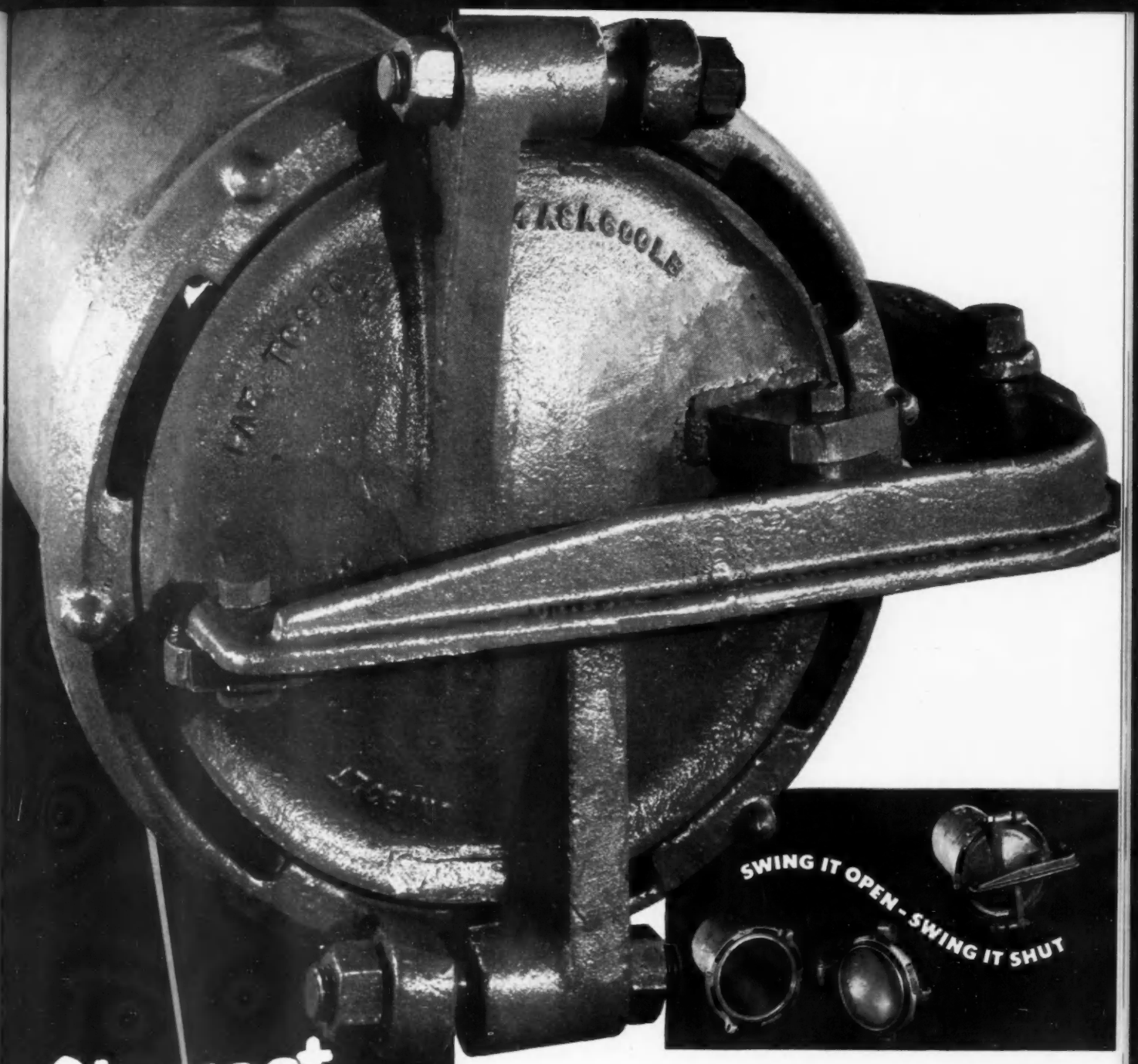
There are four spare annunciator circuits furnished for future functions.

In addition to the permanent protective devices, there are four temporary protective devices, as follows:

1-A. Low suction pressure.
2-A. High discharge pressure.
3-A. Incomplete starting sequence.
4-A. Undervoltage protection.

The function of any of these temporary protective devices causes corresponding contacts to close and open the remote teletype contacts. When the trouble is cleared and the station is to be operated remotely, it is necessary for the dispatcher to dial a start to reclose the teletype contacts. This

Tecumseh, Neb., station, showing pump house (center), pipe manifold and control building at left.



Biggest "Discovery" in Years

The UNIBOLT Hinged Scraper Trap with self-sealing gasket swings open and shut like a door by simply releasing two bolts. No heavy lifting . . . nothing to fall on workmen . . . no leaks . . . no time-consuming multi-bolt flanged closures. Installed on an oversize barrel, it's no job at all to get a pig in or out of this trap.

These simple, convenient closures are equally desirable for gas line blowdowns, strainers, terminal manifolds, or any other service where pressure vessels must be opened for inspection, cleaning, repairing, connecting to a line, etc.

Bulletin PL-*510* will gladly be sent on request.

THORNHILL - CRAVER COMPANY

P. O. BOX 1184 — HOUSTON, TEXAS

UNIBOLT SCRAPER TRAP

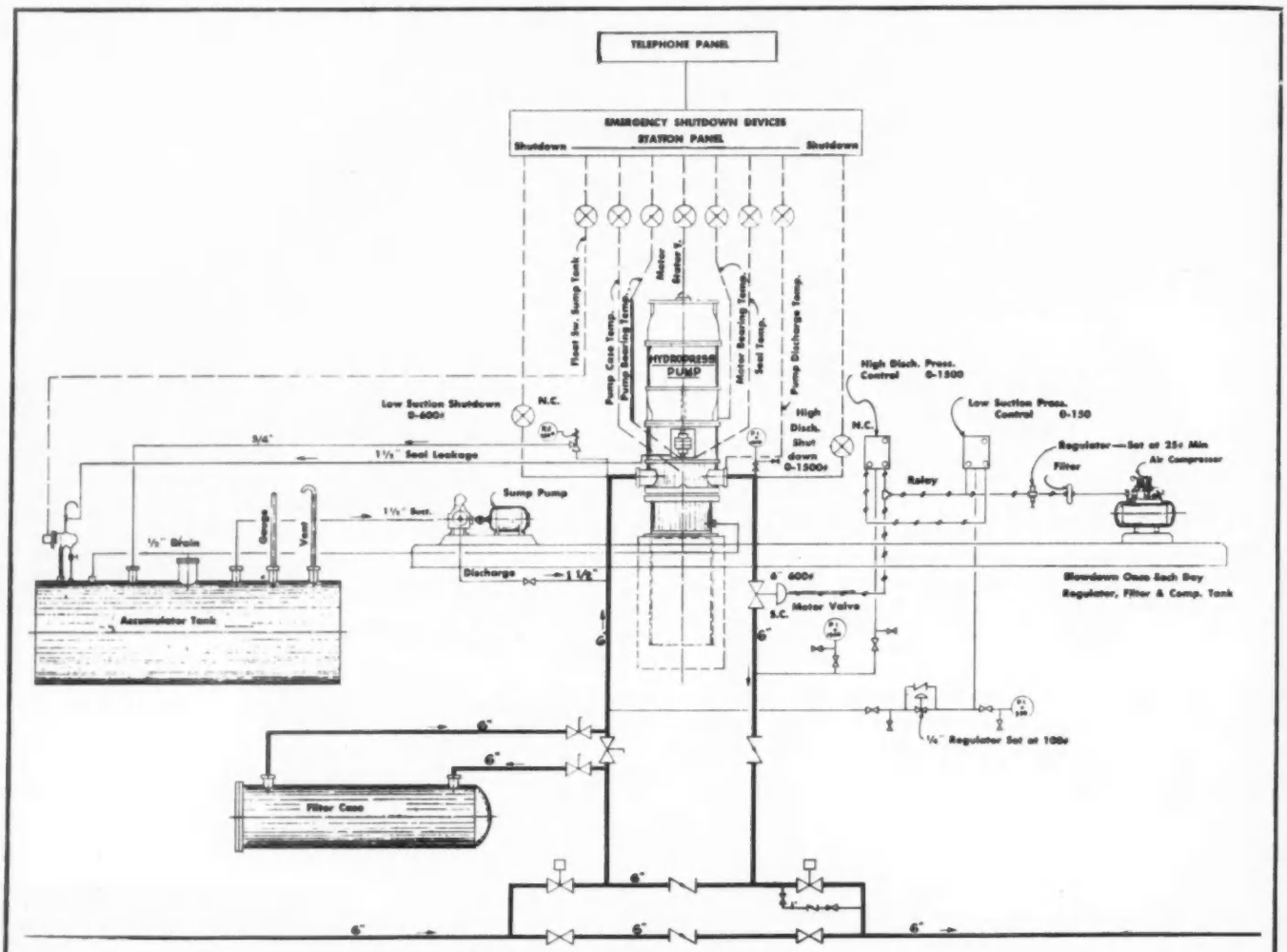


Diagram of automatic booster station.

eliminates abnormal starts caused by oscillatory operation of the protective devices.

At any time the dispatcher is unable to start the station, he may dial for an indication of the trouble and receive a teletype code indication of one of the following conditions:

- PERMANENT LOCKOUT—caused by operation of one of the permanent protective devices. Contacts close the circuit to the terminals of the telephone panel and set up the teletype circuits for a permanent lockout indication. This means that a crew will have to visit the station in order to locate the trouble and reset the annunciator before the station can be started.
- TEMPORARY LOCKOUT—caused by the temporary protective devices, contacts close the circuit to the terminals of the telephone panel and set up the teletype circuits for a temporary lockout indication. The station may be started as soon as the trouble clears.
- No LOCKOUT—which indicates that the station is in its operative position and may be started at any time.

Only one of these three trouble indicating contacts can be closed at a given time and one of them is always closed so that a positive response will be indicated. In case of conditions calling for both permanent and temporary protection exists, only the permanent trouble contacts will close.

TELEMETERING. When the dispatcher at the remote controlling station calls for readings at a station, a contact in the A.T.&T. relay cabinet will close and remain closed for approximately 37 seconds. This contact energizes the cycle timer motor in the pulse duration telemeter and also picks up a contact which will close to energize the notching relay.

The cycle timer motor in the pulse duration telemeter drives two cams, one of which actuates the moveable core in the magnetic transmitter of the telemeter, such that a reference voltage is applied to the sensing relay which begins at zero and rises in a straight line relation with time and then suddenly drops back to zero at the end of 15 seconds, this is the period for one revolution of the cycle timer motor.

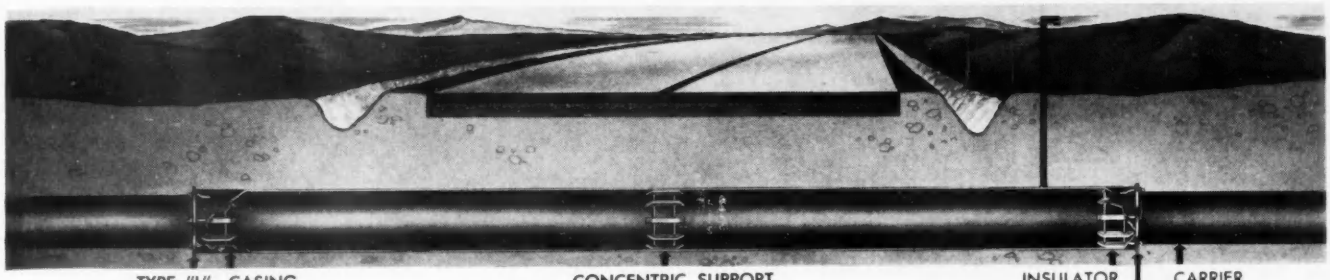
The second cam closes a contact of the telemeter after three seconds and holds it closed until the end of the 15-second period.

When a relay closes at the beginning of transmission, its contact closes the circuit between terminals of the A.T.&T. relay cabinet, this circuit sets up the teletype equipment for transmission of the readings. Contacts connect the output voltage of the discharge pressure transmitter to the sensing relay in the pulse duration transmitter. At the end of three seconds, as previously noted, contacts of the telemeter close and pick up a relay which seals in the circuit of the cycle timer motor. Contacts open in the notching relay circuit and contacts close the circuit between the terminals in the A.T.&T. relay cabinet which begins transmission of a code letter for the discharge pressure.

When the reference voltage being applied to the sensing relay reaches a value equal to the voltage being applied from the discharge pressure transmitter, the sensing relay will close and complete the circuit between the terminals which stops the trans-

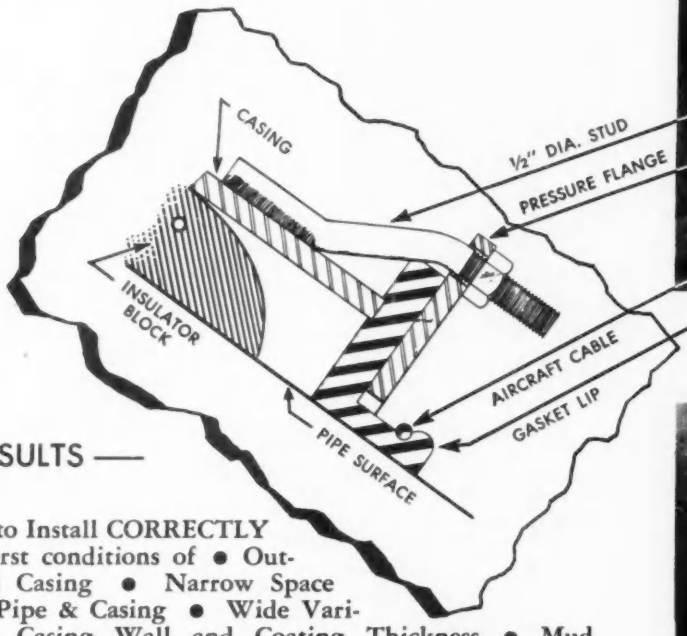
■ CONTINUED ON PAGE 288

PIPE-LINE TESTED, PROVED and ACCEPTED

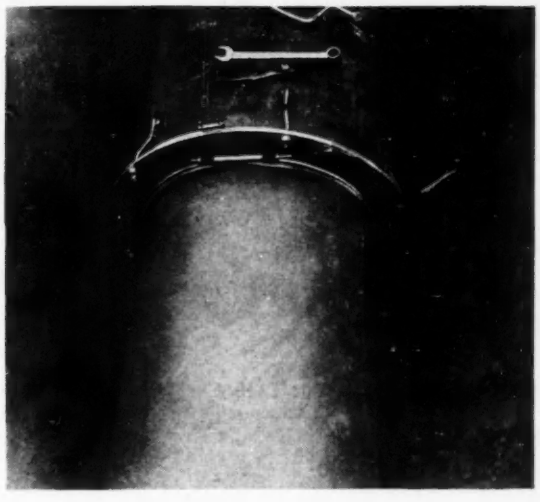


TYPE "L" WmSEAL CASING BUSHING*

A New Design: It BUTTS Against End of Casing Instead of Fitting Inside the Casing.



Assembling cable with rubber-covered union for clamping gasket lip to pipe.



THE COMPLETED INSTALLATION
Note that galvanized cable and union are insulated from pressure flange and from pipe.

RESULTS —

1. Easier to Install CORRECTLY under worst conditions of • Out-Of-Round Casing • Narrow Space Between Pipe & Casing • Wide Variations in Casing Wall and Coating Thickness • Mud • Casing ends beveled — by machine or hand torch.
2. WATER-TIGHT Seal with "L" gasket . . . . . .
   - BUTTED AGAINST CASING as pressure flange is tightened on ½" studs welded to casing.
   - TIGHT TO THE PIPE as aircraft cable (4,600# tensile) is tightened to gasket lip. Union is rubber covered to INSULATE galvanized cable assembly from bare casing structure.
3. Always Insulated from the pipe line when a Concentric-Support Insulator is installed just inside casing after the "drag section" is in place.

WRITE FOR BULLETIN 249A

AS STRONG & DEPENDABLE AS THE MEN WHO INSTALL THEM

*Pat. Pending

REPRESENTATIVES

Stuart Steel Protection Corp., Kenilworth, N. J. | H. E. Davis, Los Angeles 15, Calif. | James S. Kone Co., Amarillo, Texas | Keyes Tank Co., Provo, Utah | Keyes Tank & Supply Co., Casper, Wyoming | Canadian Equipment Sales & Service Co., Ltd., Edmonton, Calgary, Toronto, Canada

WRITE FOR BULLETIN 249A

T. D. Williamson, Inc.
TULSA 9, OKLAHOMA

8,000 Pipe Line Casings installed in 1951 with Williamson Bushings and Insulators

He knew the answers. Burt E. Hull at Trans-Arabian Pipe Line Company's Sidon terminal on Mediterranean during official opening of Tapline on Dec. 2, 1950.

Meet Mr. Pipeliner

Burt Hull's achievements in the industry stretch from the Gulf of Mexico to Saudi Arabia . . . now he has settled down—atop a pipe line.

By ERIC G. SCHROEDER

A GIVEN AMOUNT of air constrained within a limited space will furnish motive power to tunnel mountains or mine coal. It's a matter of compression!

Likewise, a given amount of skill, wit, brilliance and doggedness jammed into a 5-foot-3 human body can light cities, turn machinery, heat homes and go a long way toward winning a war. That's compression, too, right down to the name—Burt Hull!

There are several thousand miles of testimony to the achievements of the dynamic, short-set man with the dynamic, short-set name. They stretch from the Gulf of Mexico to Newark, they form a grid over millions of acres in southwestern oil fields and there are 1068 of them reaching from eastern Saudi Arabia to the Mediterranean Sea. Over those miles by virtue of his impetus goes the life blood of soldier and civilian alike—fuel in the form of oil and gas.

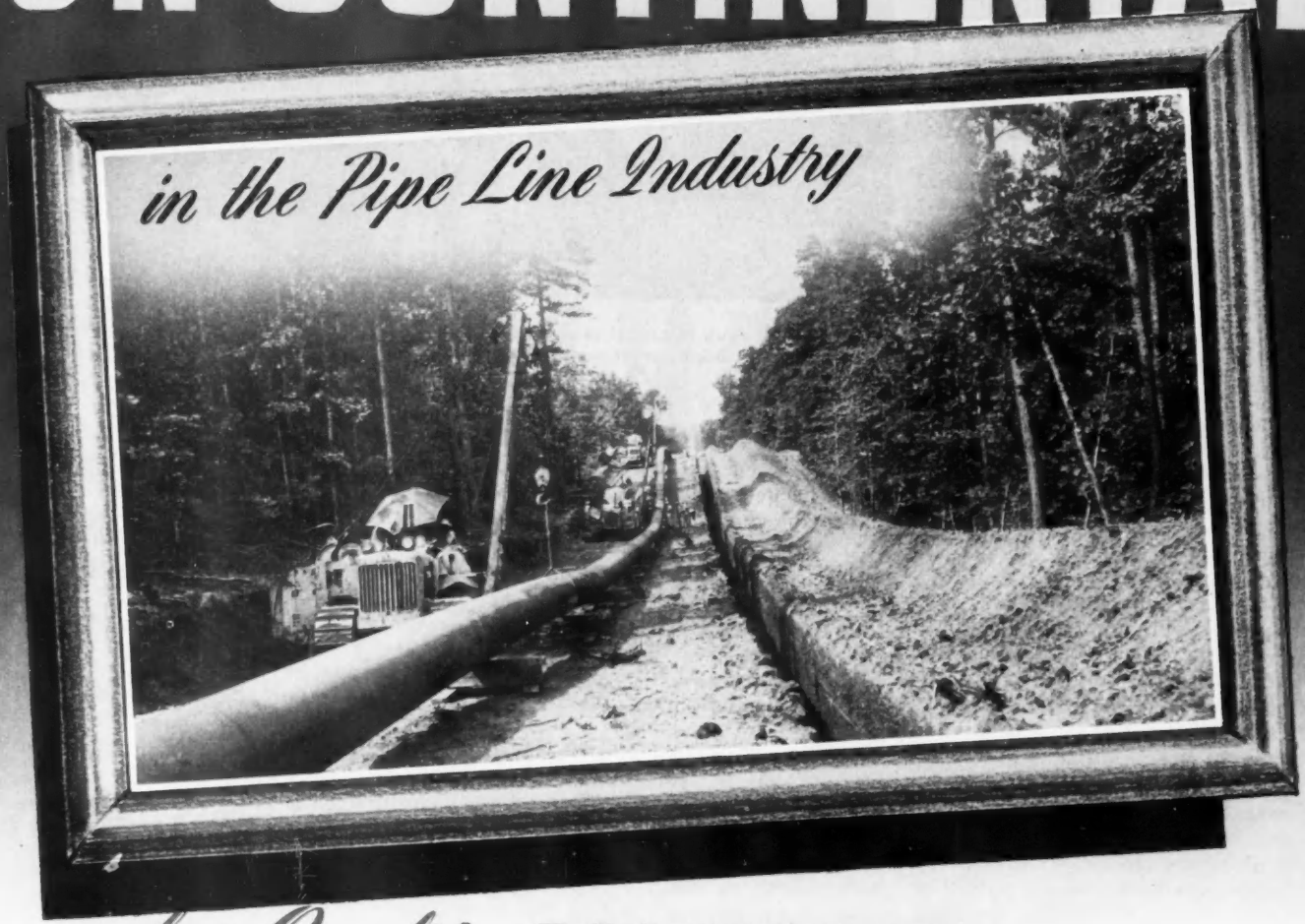
Ten years ago when Hitler's submarines were delivering their Sunday punch to shipping along American coastal lanes, eleven oil companies, frantic over the loss of tankers, decided to build a non-sinkable mode of transportation. They gave serious consideration to only one man for the job. The Texas Company, which employed him, gave the nod.

Burt Hull came out of his corner like Luis Firpo. He didn't need to get ready—he was ready! Before he completed surveying the route Uncle Sam took over the deal and formed War Emergency Pipeline, Inc. to build the lines. The chunky man with determined mouth was vice-president and general manager. W. Alton Jones was president.

The Big and Little Inch lines are as much a part of World War II as B-29's and Sherman tanks. The 24-inch crude oil line started at Longview. Its junior, the 20-inch products line, started at fourteen Gulf Coast refineries. Both ran to Little Rock and from there parallel to Newark. They crossed most of the important rivers east of the Rocky Mountains.

Work started in August, 1942. The leathery little Houston guy was the big boss of 15,000 men who filled the air with the clatter of bulldozers, sideboom cats, ditching machines and back-hoes. They worked for their chief, took pride in being "Burt Hull's gang." A. N. Horn, on loan from Cities Service, O. R. Burden and Oscar Wolfe, borrowed from The Texas Company, were staunch and

YOU CAN COUNT ON CONTINENTAL



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able lieutenants. One year to the month from the time work started, the brawny army finished its job.

Burt's father came to Texas from Ohio immediately after the Civil War. He met Lida South, born in Navarro County, Texas, wasn't long in marrying her and moved to Navasota where he was telegrapher and station agent for the H&TC railroad. Burt was born there May 23, 1884.

The family moved to Houston 14 years later. Burt carried newspaper routes for The Houston Post and made himself valuable in various ways. When Spindletop came in in 1901 Burt dropped out of high school and went to Beaumont as bill collector for The Post. He stayed until the boom waned. Oil built circulation for his paper. Later he built circulation for oil.

But Mother Lida wanted her boy back in school. So he enrolled in Texas A & M College in 1901, earned expenses and graduated with a B.S. in civil engineering. Forty-six years later at another commencement his alma mater conferred an honorary degree upon him for meritorious accomplishment, in company with General Omar Bradley.

In school Burt showed earmarks of influence and leadership among his fellow students. He was active, an extrovert with a busy mind. These talents he took with him upon graduation when he went to work for the T&NO railroad as junior engineer and draftsman at New Orleans.

Later he applied to W. T. Cushing, manager of the pipe line department of The Texas Company, for a job. He was hired. That day marked a 42-year era during which he was to build all of the company's pipe lines.

Cushing took the rookie into the office of J. S. Cullinan, company president, for an introduction. Burt's eyes twinkle at the memory. "I don't think he liked my looks," he says.

In the spring of 1907, Mr. Cullinan moved his office to Dallas and Burt came along. The company prepared to build an eight-inch screw line from Sour Lake to Tulsa. Burt surveyed the route and did the preliminary engineering. He kept his short legs pumping to stay ahead of right-of-way agents and construction crews.

There was no skilled help in the Southwest for the type line Hull was helping build. Tong men and stabbers had to be brought from Pennsylvania and Ohio. Corsicana, Batson, Sour Lake and Spindletop were the only Texas oil fields.

Nearly a half century later when Hull, fresh from world-wide achievements in pipe laying, was buying the 15-acre place north of Dallas where he now lives, he dickered amiably with the owner for farm tools and other needed equipment. He made one final request.

"Before you go," he told the abdicating landlord, "I wish you would fill those ruts down by the gate."

He was surprised by the owner's outburst. "No, sir," the latter shouted, "you can fill those ruts yourself!"

Hull was nonplussed. "Why?" he asked.

"Because," fumed the retiring owner, "you and your gang cut them when you laid that pipe through here 44 years ago!"

Burt still wonders whether destiny had tongue in cheek when, all unsuspecting, he bought a home with a pipe line under it.

After the Sour Lake-Tulsa line was finished the young Texan, no longer a rookie, was sent to the refining department in Port Arthur where in time he qualified sufficiently to be made chief engineer and was shifted to Houston. During the Carranza-Obregon regime in Mexico he served as manager of his company's subsidiary at Tampico and narrowly missed being perforated by banditos who made a business of holding up company paymasters. His ability as a boss plus his dexterity in avoiding extermination earned him a transfer back to Houston as president of The Texas Pipeline Company. The longest single hitch in his career, 21 years, was in that capacity.

Now came one of the most unique assignments the oil industry could offer. Standard of California, Standard of New Jersey, The Texas Company and Socony formed the Arabian-American Oil Co. (Aramco) and Trans-Arabian Pipeline Co. which the natives dubbed "Tapline." In 1947 Tapline started construction of the largest diameter oil line ever built, 1068 miles of 30-inch pipe from the Persian Gulf to Sidon on the Mediterranean.

Burt Hull heads down to control valve installation at Sidon terminal in Lebanon where he opened valve to officially begin operations of Trans-Arabian pipe line.—Photos courtesy Trans-Arabian Pipe Line Company.

The selection of a generalissimo for this quarter-billion dollar undertaking was almost automatic. Burt Hull! So the little guy wearing the big pants shuttled back and forth until he got the job done in December, 1950.

He knew the answers—how to nest pipe to save marine freight, how to blast limestone to make a bed for the 30-inch tubes, and most of all, how to deal with sheik and herdsman to preserve tranquility and cooperation. Most of the line was laid across a 1500-foot plateau. Four hundred fifty miles were above ground with camel crossings spaced at intervals.

Unskilled Arabs to whom a hammer, wrench or saw were unfamiliar tokens of a civilization beyond their world became skilled artisans. In Syria, with 60,000 applications for work on file, there were rumblings of discontent because the company could not hire all the unemployed. At night, by way of angry protest, a barrage of stones from native slingshots clattered against the parked machines.

Burt built the loading port at Sidon where ships often take on a million barrels of oil in 24 hours from weighted lines laid on the ocean floor. But it is the materials unloading port

Experienced

PIPE LINE
WESTERN
AUSTIN, TEXAS
CONSTRUCTORS

. . . in laying Pipe Line !

● Experienced personnel is the backbone of any organization. Western Pipe Line Constructors, Inc. has those men of experience . . . men who can lay pipe line anywhere . . . through rivers, swamps or mountains. No job is too big or too rough. Western's men are experienced in laying Pipe Line.

JAMES P. NEILL, *President* • CHAS. S. LeNOIR, *Vice-President* • E. G. MORRISON, *Secretary*

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ONAN *Oilfield*
Electric Plants

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3,000 watts, A.C.
5,000 watts, D.C.

HEAVY-DUTY PORTABLE & STATIONARY MODELS
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● ONAN oilfield electric plants provide dependable light and power for oil field applications. A complete range of A.C. and D.C. models . . . all conservatively rated for continuous, dependable service helps you choose the right plant for the job. Lightweight, air-cooled models from 400 to 5,000 watts; heavy-duty, water-cooled, gas-gasoline-driven plants from 5,000 to 35,000 watts. Air-cooled Diesel electric plants 2,500 watts. Water-cooled Diesels from 12,500 to 55,000 watts, powered by IH engines.

Write for Literature

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Another **WHITMOR** *field home*

. . . here's the sign of the finest field homes . . .

Behind this little metal identification are over 31 years of homebuilding experience – experience that means the difference between homes – or just housing! The Whitmor home has been designed for employee comfort and company prestige. You demand the best employee – give him a home that he can be proud of . . . Give him a Whitmor field home.

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at Ras Mishaab that he describes as "a dilly." Shallow water prevents ships from coming nearer than three miles to the shore. That meant building a pier or depending upon lighters.

The boss took a page from the lumberjack's book. He set A-frames at 700-foot intervals to support an aerial cableway on which a carriage, or "sky hook," carried ashore ten tons of materials per trip at 35 miles an hour. There was no demurrage on any of the 125 ships that brought supplies for the project.

The job abroad sort of wound things up with a flourish. The maestro had reached retirement age in 1949 but the company extended the date two years. He moved to the farm near Dallas in June, 1951.

Hull has great personal magnetism, a gift for winning the loyalty and respect of all who work for him. His wit and repartee flash out even at trying moments. Some of the phrases to which he has given a neat turn are legend in the industry.

He has two children, Burt, Jr., of Dallas, and Ruth, who teaches in Peoria, Ill. Their mother, the former Ruth Moser of St. Louis whom Burt married in 1914, died several years ago. The present Mrs. Hull was Lorraine Huff of Little Rock. Burt's younger brother, C. Baylor Hull, lives in Tulsa, one sister is in Seattle and one in San Antonio. His mother, 90, lives in Houston.

The veteran pipe liner has honors from Stevens Institute of Technology, the API and the 1943 Distinguished Service Award of the Texas Mid-Continent Oil and Gas Association. But closer to his heart are the friends and helpers who stretched out hands when he needed them most.

He often thinks of Cap Finney of the Jersey company. Among his lifelong company pals are C. E. Olmstead, W. S. S. Rodgers, J. Sayles Leach, Harry Klein, Gus Long, Terry Duce and many others. He gratefully remembers encouragement that came from John Suman, Bushrod Howard, Gwin Follis and Brewster Jennings in the various Standard companies.

Retired or not, Burt Hull is up to his chin again in pipe line work, a director in three or four big projects under way. Together they stretch from the Pacific to the Atlantic.

They keep him vital, alert, on the ball. And in sweaty swamps or shifting desert sands, at river crossings or over mountain trails, wherever men who work with ditchers, towcats, draglines or tongs may gather, he is still the one and only—past, present or future—Mr. Pipeliner!

Teletype Controls

■ CONTINUED FROM PAGE 282

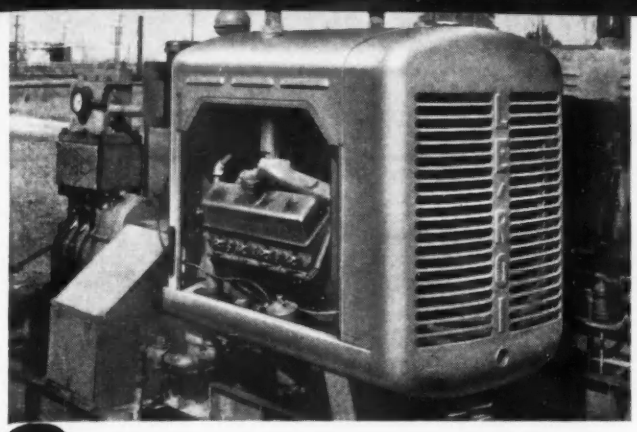
mission of the code letter. The number of code letters transmitted is an indication of the magnitude of the discharge pressure. After the end of a 15-second period which is one revolution of the cycle timer motor a relay drops out, this ends the transmission of the discharge pressure.

Telemetering of suction pressure is accomplished in the following manner: Three seconds after the beginning of the second revolution of the cycle timer motor, a contact closes and sets up the teletype circuits for transmission of the suction pressure. This is accomplished in the same way as the transmission of the discharge pressure reading as noted above. After a 15-second period, the notching relay is again operated and a relay drops out and sets up the telemetering equipment for transmission of the motor load readings. Indication of the motor load is obtained from a C.T. in phase two of the motor circuit and is supplied through the load recorder. The transmission of the load readings is the same as the transmission of the pressure readings.

The station will automatically print an identification of the measured quantities and at the end of transmission of these quantities, will print the code letters of the station.

ADDITIONAL FEATURES. When the control transfer switch is in the "manual" position, the main pump motor can be started and stopped by means of a stop-start pushbutton mounted on the panel at the station. The suction and discharge valve starters may also be operated manually by means of pushbuttons. This enables the station to be operated manually in case of emergency. Additional protection is furnished on the main pump motor by fuses. These fuses are designed to interrupt 60,000 amperes at 2300 volts in the first quarter cycle of the fault current.

In addition to the aforementioned control and telemetering system, these stations are throttled stations using air actuated, automatic valve control in the discharge line of the stations. This relieves the dispatcher of the problem of product change, the valve being automatic it assumes the operator's throttling duties at the station. Being that these stations are built on a bypass the dispatcher may at will remove both boosters from the line without seriously upsetting the line hydraulics. The application of automatic control to pipe line systems makes for higher throughput, cleaner interfaces and ease of operation.



2 Better Applications. Exclusive Le Roi distributors and factory men are oil-field power specialists. They know engines and how to recommend best operating speeds and accessory combinations to give you low-cost, lasting power.

3 Better Service. Keeping your Le Roi engines running is the sole responsibility of our distributors and Tulsa branch-office staff. Parts on hand when you need them, top-notch service men on 24-hour call, and unexcelled overhaul facilities assure your getting the most out of Le Roi oil field engines.

service for 5 years

in sour gas...never overhauled

That's Le Roi performance at this pipeline booster station, under most difficult operating conditions in district

And Le Roi's are still going strong — pumping 27,000 barrels daily, to hold 1,000 psi line pressure.

At this booster station — owned by a major pipeline company — the top-notch performance of one Le Roi F1500 led to the purchase of two more F1500's and two Le Roi L3000's.

Though one of these engines is now almost five years old, none have needed overhauling to date — and only very little maintenance has been required. This trouble-free performance has been achieved in spite of unfavorable conditions — dust, heat, and corrosive sour gas.

Because Le Roi's help keep operating expenses to a minimum, installations are being made for pipeline and other oil-field service in an ever-increasing number.

No matter what your engine application, it pays you to find out about Le Roi oil-field power from your nearby Le Roi distributor or supply house. They can show you Le Roi engines at work under conditions similar to yours, and explain the benefits of Le Roi's 3-way partnership.

LE ROI COMPANY

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Plants: Milwaukee • Cleveland • Greenwich, Ohio

Oil Field Headquarters: Tulsa, Oklahoma

See these Le Roi Distributors for a Profitable 3-way Partnership

Oklahoma
Le Roi Company Branch — Tulsa
Carson Machine & Supply Co.— Oklahoma City

East & South Texas, Gulf Coast
Southern Engine and Pump Company — Houston, Kilgore, Edinburg, Dallas, San Antonio, Corpus Christi, Texas, and Lafayette, Houma, Louisiana.

North & West Texas, New Mexico
General Machine & Supply Co. — Odessa, Snyder, Texas.
Nortex Engine & Equipment Co.—Wichita Falls, Texas.

Kansas
Carson Machine and Supply Co.—Great Bend

Illinois — Western Kentucky
Western Machinery & Engine Company—Centralia, Illinois and St. Louis, Missouri.

Michigan
Hafer Engine Service — Reed City

Rocky Mountain Area
Gehring Equipment Co. — Casper, Wyoming, Rangeley, Col.

Northern Louisiana & Mississippi
Ingersoll Corporation — Shreveport, Louisiana, and Jackson, Mississippi.

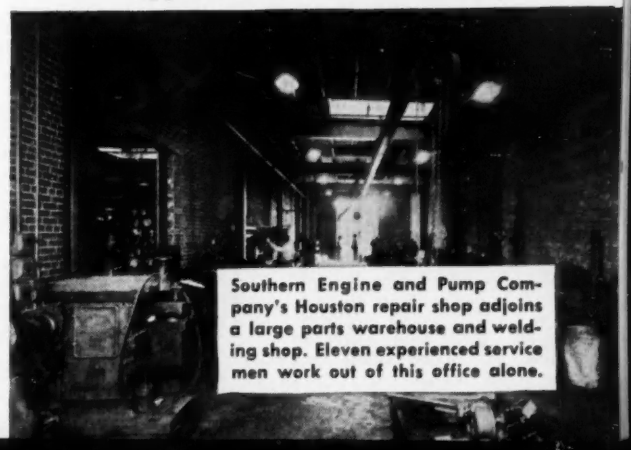
West Coast
Le Roi-Rix Machinery Co. — Los Angeles, Long Beach and Bakersfield, Calif.

Appalachian Area
P. C. McKenzie Co., Pittsburgh, Bradford.

Canada
Lucey Export Ltd. — Calgary, Edmonton, Alberta.

P-113

Typical LE ROI service facility



Southern Engine and Pump Company's Houston repair shop adjoins a large parts warehouse and welding shop. Eleven experienced service men work out of this office alone.

Pipe Line Men in the News

ONLY A MEMORY NOW ARE THESE VACATION DAYS spent at Jasper National Park by officers, directors and guests of Trans Mountain Oil Pipe Line Company. Left to right: D. L. Roberts, Canadian Bechtel Limited, and project manager of Trans Mountain; W. J. Wilkins, Gulf Oil Corporation and director of the Trans Mountain construction committee; W. M. V. Ash, Shell Oil Company of Canada, Ltd., director of the construction committee; H. H. Anderson, vice president and general manager; S. M. Blair, vice president of both Trans Mountain and Canadian Bechtel Limited; J. M. Tescher, treasurer and assistant secretary of Trans Mountain; J. S. Grepe, Jr., Pipe Line department of Standard Oil Company of California, and member of the construction committee; R. D. Baker, Standard Oil-British Columbia, Ltd., and director of Trans Mountain; J. T. Johnson, assistant secretary-treasurer; Van W. Rosendahl, Bechtel Corporation; R. F. Bruce Taylor, Toronto financial representative; R. L. Bridges, of Thelen, Marrin Johnson & Bridges, and president and director of Trans Mountain; Ivy Lee, Jr., special assistant to S. D. Bechtel; W. P. Taylor, Union Oil Company, and director of Trans Mountain; J. K. Jamieson, director of Imperial Oil Ltd., and director of Trans Mountain construction committee; R. L. Hamilton, pipeline consultant, Bechtel Corporation.

Charles Schrader Elected Head of Michigan-Ohio Line

Charles A. Schrader, who at 37 is one of the youngest executives in the oil business in Michigan, has been elected president of the Michigan-Ohio Pipeline Corporation, which owns and operates the famous pipe line that "runs backwards" from Toledo, Ohio, into central Michigan. Schrader had been vice president and general manager of Michigan-Ohio Pipeline Corporation since September, 1950. Michigan-Ohio Pipeline is a wholly-owned subsidiary of Mid-West Refineries, Inc., whose large refinery at Alma is supplied by Michigan-Ohio Pipeline.

Charles A. Schrader

Four United Gas Veterans Mark Long Service Records

Four United Gas Pipe Line Company employes noted service anniversaries this fall. H. E. Ritch, chief engineer at McComb compressor station, Jackson, Miss., has completed 35 years continuous service with United Gas or one of its predecessor companies. He began work in the drilling department at Hunter, La., and more recently served at the Hattiesburg station for almost eight years. He was transferred to McComb last February.

Ben F. Worley, superintendent of distribution for the Louisiana Mississippi division recently completed 25 years service. His first job in 1927 was meter inspector in the San Antonio district for a company later taken over by United Gas. An active participant in the annual Southwestern Gas Measurement Short Course at Norman, Okla., he served as 1951 general chairman of the school.

Otto Fillingame, chief engineer at the new Montpelier, La., compressor station and O. H. Bacon, engineer at Scotland station in Baton Rouge, La., also marked 25 years service recently.

Panama-Williams Opens Pipe Line Construction Office

M. E. (Panama) Shiflett and M. S. Williams have opened the Panama-Williams Company in the Melrose Building in Houston. The company will engage in general pipe line construction.

Shiflett is former general superintendent of Anderson Brothers Corporation. Williams was formerly a vice president of the same organization.

Shell Pipe Line Advances Heyden To Chief Engineer

O. W. Heyden, assistant chief engineer for Shell Pipe Line Corporation since 1941, has been advanced to acting chief engineer. He is a graduate of Tulane University with degrees in mechanical and electrical engineering. Heyden joined the Shell organization at Norco, La., in 1931 and served at the refinery as assistant power engineer, senior technical assistant, assistant chief engineer and acting chief engineer before joining Shell Pipe Line at Houston

O. W. Heyden

Cormit Engineering, Houston Formed By Marshall Parker

Marshall E. Parker, who has been engaged in the practice of Corrosion Engineering as a consultant, has formed the Cormit Engineering Company to broaden the scope of his activities. In addition to consulting, surveys, and design, the new company is prepared to make complete installations of cathodic protection systems on oil and gas pipelines, tank farms, and other metallic structures exposed to the corrosive action of soil or water. The company has offices in the M & M Building, Houston, and operates on the conviction that corrosion mitigation is an engineering problem.

Marshall Parker

Shell Recalls Billings From Venezuela to West Texas Area

G. G. Billings, on special assignment in Venezuela for Shell Caribbean Petroleum Company since 1950, has been named acting manager of the West Texas area of Shell Pipe Line Corporation. Billings started his Shell career in 1936 as an engineer at Colorado City, Texas. After engineering assignments at Willard, Ill., and St. Louis he moved to Houston as personnel representative in 1940. In 1941 he returned to Colorado City as West Texas area engineer. In 1942 he served briefly as Healdton division superintendent, and then moved to Cushing, Okla., as assistant Mid-Continent area manager where he was assigned until 1950.

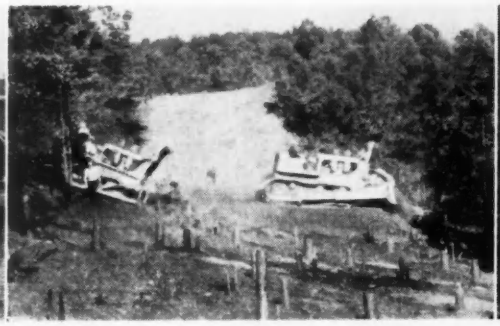
Job

ALLIS-CHALMERS Equipment is setting new performance standards

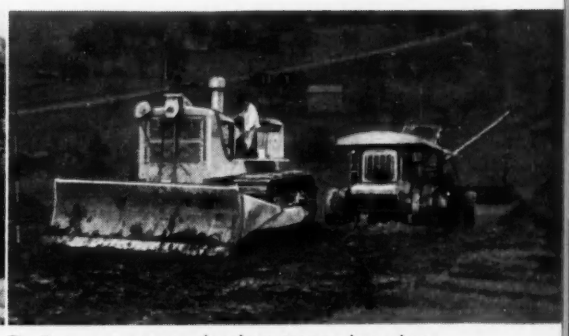
In every phase of pipeline construction, Allis-Chalmers equipment is making new friends through outstanding performance. Owners report that the HD-20 hydraulic torque converter drive tractor is the smoothest operating, most productive tractor they have ever used — whether pioneering with its balanced, heavy-duty blade, or when cradling pipe with the matched side boom.

Allis-Chalmers crawler tractors, motor graders, and Allied equipment are built to get more work done — stay on the job longer, are easy to operate and service. For real job efficiency, handle your next pipeline spread with an Allis-Chalmers fleet.

1 Power to "bull" through.



2 Capacity to speed right-of-way clearing.



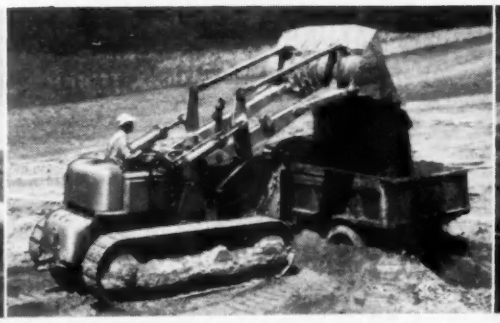
3 Torque converter develops tremendous drawbar pull.

4 Fast stringing on right-of-way.

5 Accurate feeding to bending machine.

6 Delivering miscellaneous equipment where needed.

10 Positive boom control means sure handling of pipe.



11 Digs and hauls, or loads trucks with trench padding.

12 Boom out safely with hydraulically controlled counterweights.

The Right Equipment • Genuine A-C Parts • Fast Dealer Service

Your Allis-Chalmers dealer is thoroughly experienced with pipeline problems and will assist you in selecting the right equipment for your spread. He is also ready to give you prompt, efficient service — at any time.

ALLIS-CHALMERS

TRACTOR DIVISION — MILWAUKEE 1, U. S. A.

Frank E. Hangs

W. T. Pyott

C-R-C Adds Five Engineers To Carry Construction Jobs

Awarded construction contract to build the largest, longest, and costliest products line in the United States today, the C-R-C Engineering Company, Houston, recently announced plans to enlarge its engineering staff.

J. P. Bristow

J. P. Bristow who has been active in the engineering design, construction, and operation of pipe lines for over 25 years has joined C-R-C from Fish Pipeline Construction Corporation where he served as vice president and project manager. He handled the engineering for the Texas Illinois Gas Pipeline Company line from Texas to Chicago.

Frank Edward Hangs comes to C-R-C from Transcontinental Gas Pipe Line Corporation where he was senior mechanical engineer for the design and operation of compressor stations. From 1946 to 1950 he was senior mechanical engineer and project engineer for the Texas Pipe Line Company.

W. T. Pyott, formerly chief engineer for Mannix, Ltd., in Calgary, Alberta, is a third C-R-C addition. Prior to joining Mannix in 1949, he was assistant chief engineer for Great Lakes Pipe Line Company from 1941-1949.

John C. Graper

E. L. Beeman

Another new member of the staff, John C. Graper, a mechanical engineering graduate of Purdue University, came from service with Standard Oil Company, (Ind.) where he was assigned to the products pipe line department for design drafting, field surveying, economic analysis of proposed lines.

E. L. (Roy) Beeman was associated with the National Cooperative Refinery Association at McPherson, Kansas, for nine years before joining C-R-C. Prior to that he was superintendent of pipe line terminal traffic for Globe Oil and Refining Co.

Standard Pipe Line Veteran Completes 38 Years Service

Wallace R. Finney was recently honored by P. C. Spencer, president of Sinclair Oil Corporation, and A. W. Peake, president of Standard Oil Company (Ind.), upon the occasion of his retirement as pipe line advisor to Standard Oil Company (N. J.). Spencer and Peake saluted Finney for his outstanding contributions to petroleum industry transportation during his 38 years of service.

Wallace Finney

Finney began his career in 1914 as a member of a pipe line gang operating in California, and then moved on to Wyoming to design, construct and operate gasoline plants and pipe line facilities.

A director or advisor of numerous pipe line organizations in this country and overseas, Finney joined the Standard-Jersey company in 1932. He has served as its pipe line advisor since 1944 when the position was first created. Associated with the planning operations for the Trans-Arabian and other Middle East pipe lines, Finney during the war headed the industry committee which supervised the design and construction of the Big and Little Inch emergency lines.

WE OFFER
EXPERIENCED MEN...
EXTENSIVE EQUIPMENT...
AVAILABLE FOR YOUR
PIPE LINE CONSTRUCTION—ANYWHERE
Sheehan has the men with the experience, the skill, the up-to-date equipment to do a better pipe line construction job for you. Call us in on your next job.
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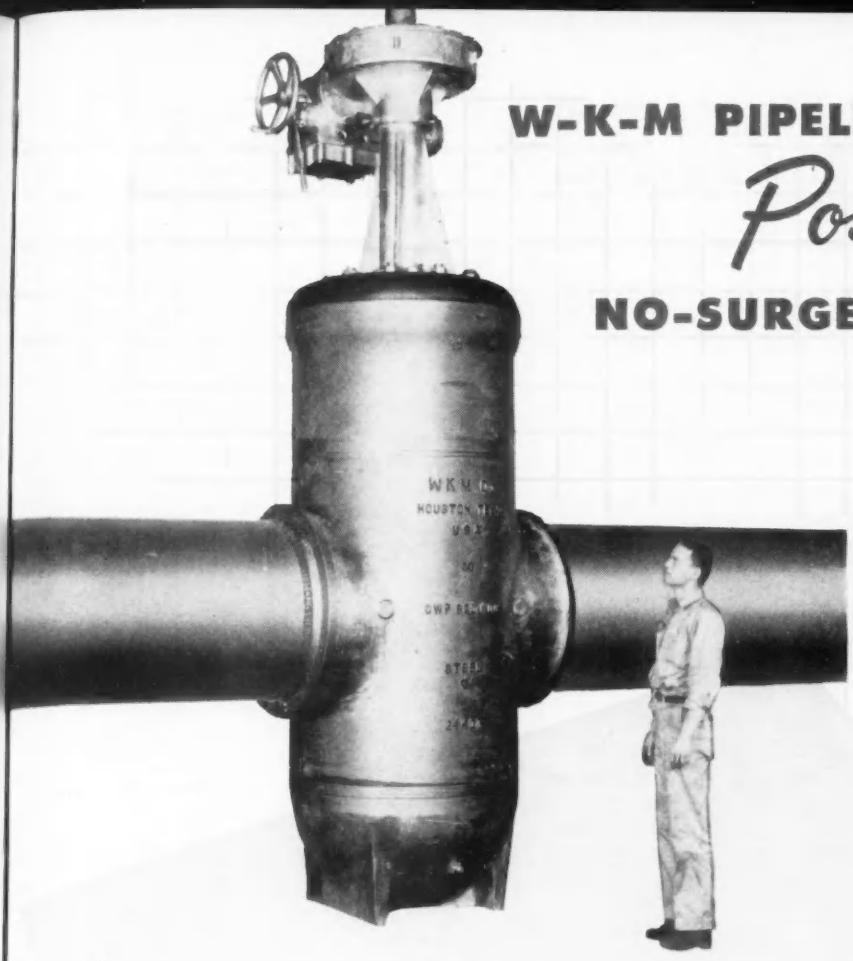
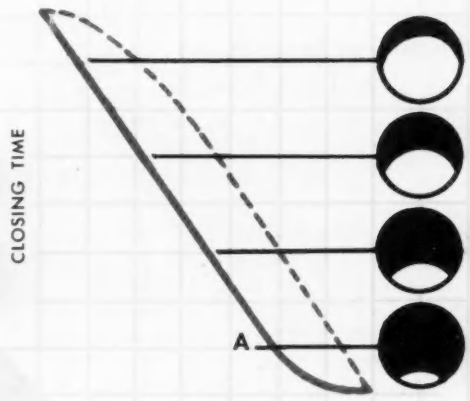
SHEEHAN PIPE LINE CONSTRUCTION CO. TULSA OKLA.
John B. Sheehan, Gen. Mgr. • Robert D. Sheehan, Supt. • James H. Nolan, Supt.

W-K-M PIPELINE VALVES GIVE *Positive* NO-SURGE OPERATION





Dotted line shows closing curve of conventional gate valve.

W-K-M Pipeline Valves may be closed as fast as required without setting up dangerous line surges.

There is no need to "baby" W-K-M Valves with partial hand operation or two-speed motor operators because they may be closed at a ***rapid constant speed, yet give the necessary gradual close off at the critical point to prevent surging.***

The curve above illustrates. From full-open to point A the rate of closing is almost straight-line. From point A (about 70% closed) the rate of closing slows up and approaches the fully closed position very slowly. In W-K-M Through Conduit Valves, the basic design of the gate and conduit provides just the right variable ratio of port area to gate travel to prevent surging, while the valve is operated at constant speed.

Specify W-K-M for surge-free closing as well as the many other advantages which have been proved and tested on the world's leading pipelines.

W-K-M Pipeline Valves have Through Conduit Design, Leverlock Operation, Parallel Expanding Gates, Pressure Seal Bonnets, Replaceable Seats.

W-K-M Valves are made in sizes from 2" to 30", in series 300-400-600-900-1500.

W-K-M COMPANY

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W-K-M *Valves*

MOST OF THE WORLD'S NEWEST PIPELINES ARE TIED TOGETHER WITH W-K-M VALVES

PIPE LINE *Construction*

By ALICE L. GIVEN
WORLD OIL Staff

Canadian Line Progressing More Rapidly Than Expected

With completion of a particularly rugged 150-mile stretch on its 800-mile crude line, Trans-Mountain Oil Pipe Line Company has moved its completion date up three months to an August, 1953, conclusion. It is anticipated that almost half of the line will be welded before winter forces operations to a standstill. Two construction companies, operating three spreads in British Columbia, have worked out of Vavenby, Grantbrook, and Vermount.

In 1953 operations will stretch from Acheson to Edson, west of Valemount to Blue River, east of Kamloops to Merritt, Coquihalla to Hope, and from Chilliwack to Burnaby near Vancouver. Welding progress this year has been at the rate of about three miles per day.

Earlier the company had announced it would build three pumping stations instead of the two originally planned for the line. New discoveries in Alberta oil fields and consequent revision of estimates of production influenced the decision to provide a throughput capacity of 200,000 barrels daily instead of the original 75,000 barrels. It is estimated that Alberta oil fields have a potential production in excess of 275,000 barrels daily.

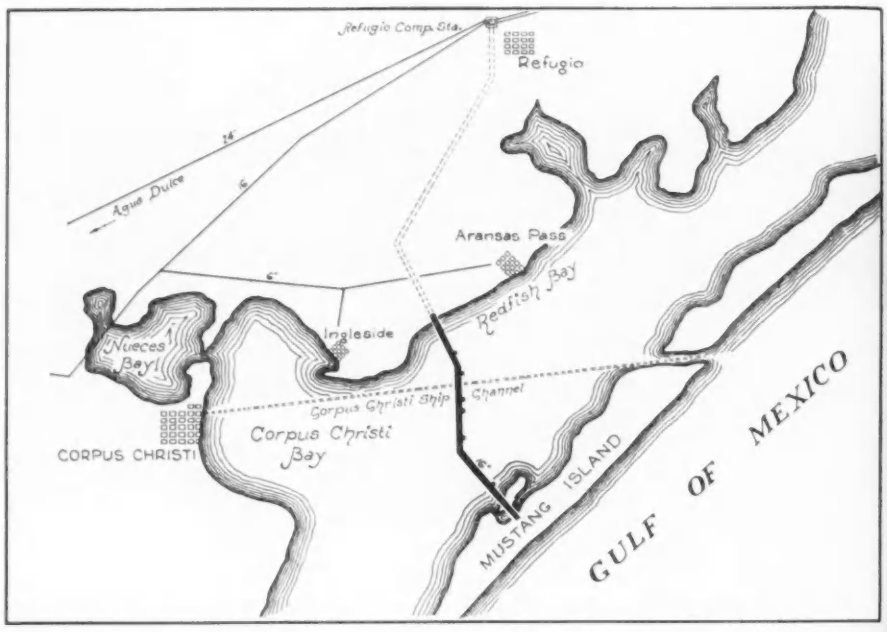
Construction is being carried on by Comstock Midwestern Limited and Mannix Limited under the agency of Canadian Bechtel Limited.

United Fuel Gas Requests Permit to Develop Storage

United Fuel Gas Company of Charleston, W. Va., hopeful of expanding its underground natural gas storage facilities, has requested permission of the Federal Power Commission to construct 50 miles of pipe line and a new 2640 horsepower compressor station in Wood County, W. Va., at an existing storage pool.

The proposed pipe line would extend southerly from the Wood County station to an existing compressor station in Putnam County, W. Va.

The project is estimated to cost more than $6 million.



This drawing, distorted slightly to enlarge the bay area, shows the route of United Gas Company's new pipe line which reaches from Mustang Island to Refugio Compressor Station.

Marine Pipe Line in Gulf Area Is Nearing Completion

A ten-mile marine natural gas pipe line is rapidly nearing completion under the waters of Corpus Christi Bay. United Gas Pipeline Company has reported that seven miles of the 16-inch line was completed by the end of September, as was 18 miles of 20-, 24- and 26-inch line which extends from the marine line to the company transmission system near Refugio, Texas.

The pipe line originates on Mustang Island, some ten miles out in the shallow bay area, but underpasses two ship channels before reaching its connection with the land line. The pipe line in the 35-foot Corpus Christi ship channel area is laid 50 feet below sea level, and is also submerged a safe distance where it crosses the proposed route of the Gulf Coast Intercoastal Waterway Cut-off, a shipping channel to be dug in the bay near the coast. With these two exceptions the balance of the line is in relatively shallow water.

Readied for use at a cleaning and coating yard on the banks of the ship channel at Corpus with a coating of enamel and fibre glass, and then weighted with a jacket of reinforced concrete, the 40-foot lengths of pipe are hauled by barge to the construction site where they are lowered to the bottom. The rear half of the double barge is partially filled with water to give the construction ramp a natural stem to stern incline to make it easier to slide the pipe off the back end. A side-boom maneuvering up and down a plank runway in the middle of the barges "walks" each new section of line down into the water.

Ithaca Company Authorized Increased New York Service

Temporary authorization to New York State Electric & Gas Corporation, Ithaca, N. Y., has been granted by the Federal Power Commission to build 9.5 miles of pipe line and to install 1100 horsepower at an existing compressor station near Auburn, N. Y.

The ten-inch pipe line would parallel the company's line from Auburn to Seneca Falls, N. Y., to help the com-

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Lower Cost—Costs Less to Maintain

- Built with the rugged ability to deliver constant power for pipe line pumping jobs.
- Designed for easy low-cost maintenance, Allis-Chalmers medium speed engines have less wear on pistons and cylinder walls.
- They have oversize rod and main bearings, forced feed lubrication, efficient high velocity cooling system, overhead valves, valve inserts, removable wet cylinder liners and enough iron in the block to keep out warping and to keep parts in proper alignment.

Yes, Allis-Chalmers engines are heavy and rugged, but they cost less to buy and less to maintain.

COMPARE
Allis-Chalmers Quality
Allis-Chalmers First Cost
Allis-Chalmers Parts Cost
With those of any other engine.

FRED E. Cooper, Inc.

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Houston, Odessa, Los Angeles

pany meet increasing demands for natural gas in the Auburn-Geneva area. The construction is estimated to cost $649,806. The authorization was made temporary pending submission of a satisfactory tariff and service agreement.

Contract Is Let For 53 Miles Crude Pipe Line In New Mexico

Texas-New Mexico Pipe Line Company has awarded a contract to Bishop and Lock Construction Company, Dallas, to construct approximately 53 miles of crude oil pipe lines in New Mexico. The lines will extend the company's existing sweet crude gathering facilities in the Lovington Pool in southeast Lea County, N. M., to the Saunders area in northwest Lea County.

The contract provides for the construction of approximately 42 miles of 8⅝-inch line; four miles of 6⅝-inch line and seven miles of 4.5-inch line.

Work is scheduled to begin immediately.

Gulf Interstate Gas Plans Louisiana-Kentucky Line

Gulf Interstate Gas Company, a new Houston corporation, has applied to the Federal Power Commission for authorization to build an 860-mile pipe line extending from a point in Acadia Parish, La., and extending across Mississippi, and Tennessee to a terminus in Boyd County, Ky. The proposed system which is estimated to cost $127.8 million, would be used to transport 375 Mmcf of gas per day to United Fuel Gas Company of Charleston, W. Va., through 30-inch pipe.

The project would also include 229 miles of various size lateral lines and five compressor stations, each with a capacity of 8000 horsepower. The company proposes to commence transporting gas by November, 1954, and hopes to get construction underway by next May.

Nyack, N. Y., Company Buys Additional Gas Pipe Lines

Rockland Light and Power Company of Nyack, N. Y., has been authorized by FPC to acquire and operate natural gas properties located in Rockland and Orange counties, N. Y., now owned by Rockland Gas Company, Inc., of Spring Valley, N. Y. Rockland owns and operates 249 miles of gas lines and serves 20 communities in that area. The transaction was made for $1,220,000.

Small Diameter Pipe Shortage Is Critical And Will Affect Entire Industry If Not Alleviated Soon

A critical shortage of small diameter pipe is slowing down field gathering operations by curtailing construction of crude oil and petroleum products pipe lines according to a report by the Committee for Pipe Line Companies which has been submitted to J. Ed Warren, deputy administrator of the Petroleum Administration for Defense. A great quantity of old pipe which normally would be scrapped, is being reconditioned for further industry use.

A study of pipe line requirements for the next three years indicates that far more new line pipe from two-inch through ten-inch will be needed than has been available in the past. A questionnaire answered by 41 pipe line companies has established three significant facts:

- An average of 1660 feet of pipe ten-inches and under in diameter, weighing 14.16 tons, is needed to connect each new oil well to a pipe line outlet.
- The supply of salvable pipe in the ground is diminishing. Less than half as much is available for take-up in 1952 as in 1951, and this percentage will decline further in 1953 and thereafter.
- There is a serious shortage of thin-wall pipe.

The pipe line companies contributing to the study make up the nation's largest group of carriers, operating 39,500 miles of crude oil lines, and 16,000 miles of products lines. In December, 1951, these crude oil lines gathered more than four million barrels of oil daily and during 1951 connected 11,204 newly drilled producing wells.

J. L. Burke of Tulsa, president of Service Pipe Line Company and chairman of the Committee for Pipe Line Companies, urged the manufacture of more small-diameter pipe. The study, he said, reveals a substantially increased percentage of the industry's need must be met by new pipe; over 50 percent more 3- and 4-inch and almost four times as much six-inch must be made available as new pipe this year than was available in 1951. He added that the need for new pipe will increase in 1953 and thereafter as available take-up and salvage declines.

Burke pointed out that the large tonnage of steel already committed to drilling and refinery expansion programs will be wasted unless matched with sufficient footage of small-size pipe for the indispensable pipe line transportation link. The total tonnage of 2- through 10-inch line pipe required is not large compared to total steel requirements of the oil industry but it is very important that sufficient small-size footage be provided if the production resulting from the nation's drilling and refinery expansion program is to be realized.

Table 1 shows the estimated products line requirements for 2- through 10-inch pipe that will be needed to meet PAD's approved drilling program in 1952 through 1955:

TABLE 1
Requirements for 2- through 10-inch New and Second-hand Line Pipe (Tons)

SIZE	1952	1953	1954	1955
2"	7,678	8,523	9,298	10,040
3"	12,486	13,830	15,083	16,285
4"	73,776	81,265	88,734	95,891
6"	77,530	81,905	88,630	95,074
8"	123,900	128,726	135,651	142,288
10"	124,569	133,796	144,624	155,000
Drilling Program—(Wells)	50,000	55,000	60,000	65,000
Producing Wells To Be Connected	23,600	26,000	28,400	30,700

The report shows that during 1951 the companies cooperating in the study had to buy heavier-wall pipe than was necessary to perform gathering operations. If pipe in desired wall thickness had been available the industry could have saved 6900 tons of pipe costing about $1 million.

The study and report give PAD a tool for use in forecasting small-diameter pipe requirements for crude oil and products lines. The reporting companies expressed concern over the possible consequence of underestimating these requirements in relation to the other demands on pipe rolling facilities such as those for oil country tubular goods. The nation's oil needs cannot be supplied without adequate small-size pipe to connect the new wells and to move the refined products.

Compressor Expansion Asked By Columbia Gas Companies

Authorization to add 17,920 horsepower to existing compressor station capacity has been asked of the Federal Power Commission by Atlantic Seaboard Corporation and Virginia Gas Transmission Corporation, both subsidiaries of Columbia Gas System, Inc. The additional horsepower would serve the existing 26-inch line which

PIPE LINE PROGRESS

2700 MILES OF LINE PIPE FOR Tennessee Gas Transmission System

Early in World War II, Tennessee Gas Transmission Company was authorized to construct its 24-inch natural gas pipe line from south Texas to West Virginia. Completed in 1944, this original line helped to supply fuel for the increasing demands of the central East.

This was but the beginning of a great natural gas transmission system that has continued to grow and expand. Today it serves additional markets in Ohio, New York and the New England states. The illustration shows recent 26-inch looping to increase main line capacity.

2700 miles of pipe in 16-inch, 20-inch, 24-inch and 26-inch diameters have been shipped by A. O. Smith as its part in supplying Tennessee Gas Transmission's requirements for the original as well as subsequent construction, including looping and extensions that have been completed and are in progress.

Ever since 1927, when A. O. Smith began volume production of welded steel line pipe and introduced internal expanded pipe to obtain greater yield strength, it has met the challenge of pipe line expansion. Today, A. O. Smith line pipe constitutes a large part of the petroleum and gas transmission systems that interlace this continent.

A. O. Smith Line Pipe is available in a complete range of sizes and wall thicknesses, from 8⅝-in. to 36-in. diameters.

FIRSTS by A. O. Smith: Welded line pipe • Internally expanded pipe • Light-wall large-diameter pipe • World's largest producer of large-diameter welded steel pipe.

The A. O. Smith Casing Mill is operating at capacity to supply vitally needed casing for the Oil and Gas Industry.

A. O. Smith

LINE PIPE • CASING

Chicago 4 • Dallas 2 • Denver 2 • Houston 2
Los Angeles 22 • Midland 5, Texas • New Orleans 12
New York 17 • Pittsburgh 19 • San Francisco 4
Seattle 1 • Tulsa 3 • Washington 6, D.C.

International Division: Milwaukee 1

DEPENDABILITY THROUGH RESEARCH AND ENGINEERING

extends from Clendenin, W. Va., to Rockville, Md.

The companies propose to construct a new 5000 horsepower compressor station in Braxton County, W. Va., a 6600 horsepower station in Upshur County, W. Va., and a 5000 horsepower station in Shenandoah County, Va. In addition the project would include the supercharging of three units now installed from 880 to 1100 horsepower and the installation of one additional 1100 horsepower unit at an existing station in Hardy County, W. Va.

The project is estimated to cost nearly $7 million.

1953 Pipe Delivery Assured Texas-California Crude Line

Pipe deliveries for the 960-mile crude oil pipe line from Wink, Texas, to Norwalk, Calif., are scheduled to begin in January according to an announcement by Consolidated Western Steel Division, United States Steel Company. Consolidated has agreed to supply Ebasco Service Inc. of New York, agents for West Coast Pipe Line Company, with about 40 percent of the 210,000 tons of steel pipe estimated to be required.

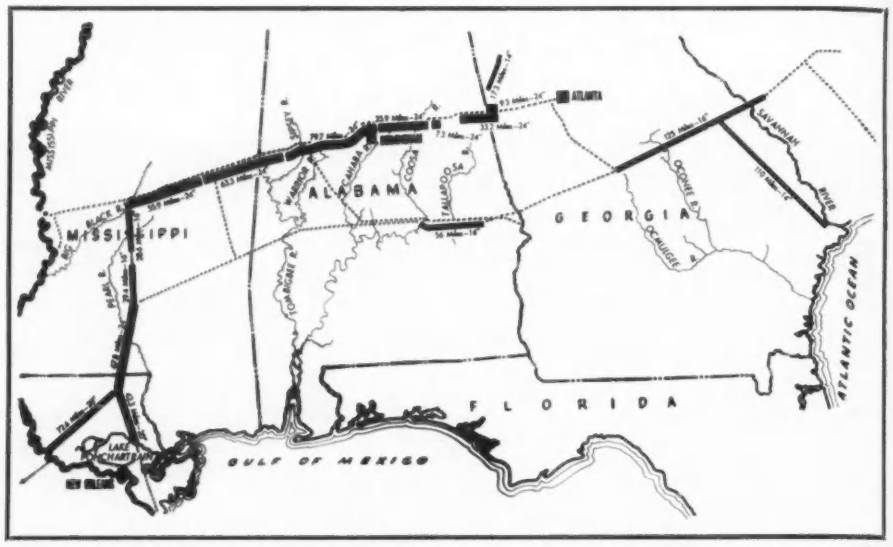
Kaiser Steel Corporation will supply West Coast Pipeline Company, with 88,000 tons of steel pipe.

Kaiser Steel will begin delivery of the order, which represents 45 per cent of the total tonnage of pipe requird for the line, in the first quarter of 1953. The entire order will be filled by the end of the third quarter.

The pipe line which will be 24 and 26 inches in diameter, will have an initial capacity of 200,000 barrels daily, increasing later to 300,000 barrels. This project is cited by many as a necessary overland link with the Pacific Coast in case of national emergency.

Gas Line Near Edmonton Now Ready For Delivery

With only auxiliary equipment remaining to be installed, the Ajax Petroleums Limited has announced completion of a gas pipe line system near Edmonton, Alberta. Consisting of a 30-mile gathering system in the Morinville area and a 20-mile, 10¾-inch line to the Canadian Chemical Company's plant at Edmonton, the system will deliver 30-35 Mmcf of gas daily to the chemical company. The pipe line was valued at $1.7 million when financed last summer.



EXPANSION PLANNED DURING 1952-53 by Southern Natural Gas Company is indicated on the map by solid lines routing loops and new lines to be constructed by Houston Contracting Company, Ltd., and H. C. Price Company. The dotted line indicates Southern Natural's existing route, along with proposed construction west of the Mississippi River and south of Lake Pontchartrain, plus its South Carolina extension.

New England Municipalities Lose Case to Algonquin Line

A New York court justice recently prevented further delay for construction of the Algonquin Gas Transmission Corporation pipe line across New England when he ruled that two protesting residents of Cortlandt, N. Y., were not sincere but trying to gain excessive payments for right of ways. Justice James W. Bailey therefore ordered the pipe line company to seize the contested easements within the city of Cortlandt and ended a two-week work stall.

Further court action took place in Danbury, Conn., where the line crossed 15 town highways in all. Judge Howard W. Alcorn, Superior Court, ruled that the town had no right to halt the project because the town had legal action against Algonquin pending in court.

Alabama Gas Company Plans 70 Mile System for Georgia

Construction of a 70 mile system to supply natural gas to four communities in northwest Georgia has been proposed in an application filed with the Federal Power Commission by Chattahoochee Natural Gas Company of Birmingham, Ala.

Chattahoochee's proposed system would connect with Southern Natural Gas Company's facilities at a point in Floyd County, Ga., and would serve Trion, Summerville, LaFayette and Dalton, Ga. Southern Natural has agreed to supply Chattahoochee with 7,450,000 cubic feet of gas per day. The project cost is estimated at $1.5 million.

Southern Natural Awards Two Contracts For 833-Mile Line

Contracts have been awarded to Houston Contracting Company, Ltd., Houston, and H. C. Price Company, Bartlesville, Okla., by Southern Natural Gas Company of Birmingham, Ala., for construction of 833.4 miles of loop and new lines in Louisiana, Mississippi, Alabama, Georgia and South Carolina.

Included in the contracts are 353.3 miles of 24-inch, 114.9 miles of 20-inch, 239 miles of 16-inch and 127.3 miles of 14-inch pipe line. This includes multiple crossings of sixteen major rivers.

The contracts to the two construction companies cover an important phase of the $76 million program planned by Southern Natural during the next three years. In that time 1254 miles of new pipe line and 22,250 compressor horsepower will be added to Southern Natural's present system, bringing the daily delivery of natural gas to a 1.02 billion cubic feet capacity by 1954.

Houston Contracting scheduled work on 88 miles of main line loops which has received emergency authorization by the Federal Power Commission, to commence late last month. It is anticipated that the remainder of the program will be approved by FPC shortly.

The Price Company contemplates having two spreads in action on the project early next year, while a total of four crews will be assigned to the project by Houston Contracting Company. Completion date for the entire 833 miles is scheduled for December, 1953.

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PITT CHEM quality-control starts paying off from the minute you start coating—and keeps on paying off with every mile you cover. Pitt Chem Hot Applied Enamels not only require less heating time, but they also flow better from kettle to pipe. Their uniform application characteristics and excellent bond helps you to cover *more miles per day* by minimizing coating delays. And, for the same reason, you'll coat *more pipe per ton of enamel.*

These outstanding qualities of Pitt Chem Tar Base Enamels stem directly from our unique position as a basic and integrated producer of pipeline enamels . . . a position that enables us to carefully control each phase of production from coal to finished coating. And remember this: Pitt Chem Pipeline Enamels are manufactured in a plant devoted *exclusively* to coal tar coatings. *We'll gladly provide more product information, technical data or field application assistance on request.*

★ Standard Grade Tar Base Enamel
★ Modified Grade Tar Base Enamel
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Canada Approves Westcoast's Peace River-Vancouver Line

Natural gas for the Pacific Northwest area came a step closer on October 10 when the Canadian Board of Transport Commissioners granted an order giving Westcoast Transmission Company Limited permission to construct a 723-mile, 24-inch pipe line to deliver Peace River area gas to Vancouver, with a branch line to be constructed to a point near the United States border, just east of Vancouver.

The board's decision followed the submission of a comprehensive report submitted by Dr. George S. Hume, director of Scientific Surveys in the Federal Department of Mines and Technical Surveys, and Alexis Ignatieff, a senior engineer in the department. The report, an extensive study of the gas reserves of the Peace River area lying in both Alberta and British Columbia, placed the estimated proven and probable reserves of the area at more than 2½ trillion cubic feet. It is estimated that about 75 percent of that gas is recoverable. By far the greater part of that volume, nearly 1.6 trillion feet, falls in the British Columbia side of the area, with the Fort St. John area being the largest single field. A notable feature of the British Columbia reserves is that nearly all of them have been discovered and evaluated since March of this year.

The only remaining hurdle yet to be crossed before gas can cross the border into the Pacific Northwest states is the approval of the Federal Power Commission in Washington, D. C. It is expected that the Commission will hold its hearings sometime in November or December of this year.

Westcoast Transmission Company Limited, is continuing with preparations for construction of the pipe line. The airborne survey of the route has been completed and three survey crews are at work staking the location on the ground.

The Board, in handing down its October decision, stipulated that the line, to cost an estimated $111 million, must be completed before October 31, 1955. The company plans, however, to start construction early next year if the Washington, D. C. hearing is favorable. It is estimated that the line would be completed some time in the fall of 1954.

The company's producing associate, Pacific Petroleums Limited, is continuing to develop additional reserves in the Peace River area. At present ten drilling rigs and two seismic crews are in operation in the area. Current expenditures in this work are running at the rate of approximately $10 million per year.

Newark, N. J., Company Builds Short Gas Transmission Line

Public Service Electric and Gas Company of Newark, N. J., has received authorization from the Federal Power Commission to build 16.13 miles of transmission pipe line to transport natural gas received from Texas Eastern Transmission Corporation of Houston.

FPC specified construction of about 11 miles of 16-inch transmission line from the Texas Eastern system at Linden, to extend to Harrison, N. J. At Harrison 2.04 miles of 12-inch and almost 3 miles of 10-inch pipe will be built to terminate at the Harrison gas works and the West End gas works at Jersey City. Construction is ordered finished and in operation within six months. The project is estimated to cost $4.2 million.

Mississippi Valley Acquires 170 Miles Natural Gas Line

Mississippi Valley Gas Company, Jackson, Miss., has been authorized by the Federal Power Commission to acquire and operate natural gas transmission facilities formerly owned or operated by Mississippi Gas Company of Meridian, Miss.

Mississippi Valley will pay more than $3 million for 71.5 miles of pipe line, a 600 horsepower compressor station, and other physical equipment owned by Mississippi Gas in Clay, Monroe, Chickasaw and Lee counties. In addition it will operate by assignment of lease, about 99 miles of pipe line in Winston, Choctaw, Webster, Calhoun, Oktibbeha and Chickasaw counties, all operated under lease from North Central Gas District.

Phillips Takes Over McCamey To Brookshire, Texas, Line

An all-welded ten-inch crude pipe line from McCamey to Brookshire, Texas, has been purchased by Phillips Pipe Line Company from its former owner, Shell Pipe Line Corporation. This line runs a distance of 394 miles and roughly parallels the Rancho Pipe Line System. Rancho is a 455-mile, 24-inch crude line now under construction from West Texas to the Gulf Coast area. It is being built by an association of pipe line companies under the direction of Shell.

Standard-California Plans Line From Pasco to Seattle

Plans for construction of a 140-mile petroleum products pipe line in the state of Washington have been announced by Standard Oil Company of California and its subsidiary, Salt Lake Pipe Line Company.

The eight-inch pipe line will be built from Pasco, on the Columbia River, to Spokane. The line's initial capacity will be 12,000 barrels a day with estimated cost of construction, which will include a pumping station at Pasco, set at $4.5 million.

C. E. Finney, Jr., president of the pipe line company, announced that actual construction work on the line will begin as soon as right of way clearances can be obtained and delivery of pipe is assured. It is expected that the line will be completed and in full operation by the middle of next year.

Products to be shipped through the proposed new line will be brought to Pasco by barge up the Columbia River, and through a pipe line completed from Salt Lake City to Pasco two years ago. This line, built and operated by Salt Lake Pipe Line Company, carries products manufactured in a newly-constructed refinery at Salt Lake City, and is part of an integrated transportation system developed by Standard to provide greater assurance of supply to its customers.

Columbia System Companies Ask Permit for Gas Program

Four subsidiaries of the Columbia Gas System, Inc., have applied to the Federal Power Commission for authority to construct a total of about 279 miles of natural gas pipe lines, and to retire about 178 miles of line together with certain compressor facilities in Pennsylvania, West Virginia, Maryland and Ohio.

Construction and retirement of line as proposed is estimated at more than $11.1 million and is requested to improve service to existing customers rather than to supply new markets.

Involved are Manufacturers Light and Heat Company, Natural Gas Company of West Virginia, Cumberland and Allegheny Gas Company and Home Gas Company, all of Pittsburgh. In addition Manufacturers proposed to take over all facilities and assets of Cumberland and Allegheny which consist of about 113 miles of line between Cumberland, Md., and Lewis County, W. Va., with numerous laterals extending off the main line.

Transco Construction Brings Compressor Power to Maximum

Transcontinental Gas Pipe Line Corporation, which supplies natural gas to New York, New Jersey and Philadelphia utilities, has completed additional compressor units to increase its daily delivery capacity to the authorized maximum of 555 million cubic feet.

All of the company's presently certificated 259,210 horsepower capacity became available in August when the third steam centrifugal unit at the Eunice, La., compressor station went into service.

Five new customers are taking gas from Transcontinental's line: Duke Power Company at Williamston, S. C., Piedmont Natural Gas Company at Greenville, S. C., Mid-Georgia Gas Company at Conyers, Ga., Frederick Gas Company at Frederick, Md., and Laurens Glass Works, Laurens, S. C.

Beginning this month, Transcontinental's actual deliveries are expected to average substantially above 500 Mmcf a day.

•

El Paso Natural Gas Company has been refused permission by FPC to construct 822 miles of pipe line in Texas, New Mexico and Arizona.

TGT Adds 25,520 Horsepower To Northeast Pipe System

Four new compressor stations under construction for Tennessee Gas Transmission Company in the Northeast have been completed for service this winter and will add 25,520 horsepower to the existing system. At Carrolton, Ohio, a 7920 horsepower station was put in service in late August. The second completion was effected at Mercer, Penn., in September when 6600 horsepower was added to the system. Last month 5000 horsepower was added at West Winfield, N. Y., with the completion of the station there, while an additional 6000 horsepower was completed at Nassau, N. Y. This construction brought the total TGT horsepower available for service to 1,310,000 Mcf per day.

In addition 16 existing stations will be enlarged, adding a total of 68,380 horsepower to the system, and 528 miles of main line pipe will be laid parallel to the existing system.

•

Lone Star Gas Company of Dallas has proposed the construction of 22 miles of 2- to 16-inch line for use in the Fort Chadbourne field of West Texas to gather gas for delivery to a proposed $3 million gasoline plant near Winters, Texas.

FPC Approves Underground Gas Storage for Illinois

Approval of a project for underground storage of natural gas in Kankakee and Iroquois counties, Illinois, has been granted Natural Gas Storage by the Federal Power Commission. The project which is estimated to cost $17 million, will store gas for use by Natural Gas Pipeline Company of America and Texas Illinois Natural Gas Pipeline Company.

Included in the project is the drilling of 25 wells, construction of 16.7 miles of 30-inch pipe line, a 10,000-horsepower compressor station, approximately 8.75 miles of well lines, and other auxiliary equipment.

Later the company will expand the area and add two more 30-inch pipe lines, about 43 miles in length, and drill 25 additional wells. Over a five-year period of development the total investment will amount to approximately $42 million.

•

Toronto Pipe Line Company has awarded a contract to R. H. Fulton & Company, Lubbock, Texas, for construction of a total of 108 miles of crude oil pipe line from the Yenter Field in Logan County, Colo., to a terminus in the Platte line near Gurley, Nebr.

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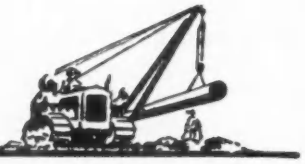
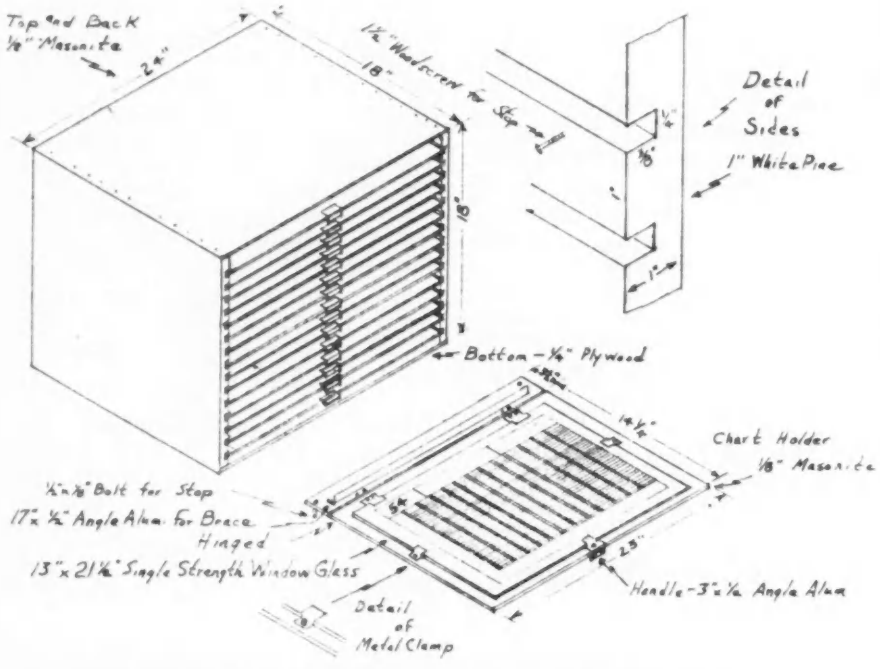


$10 is paid for each illustrated acceptable contribution. Mail to The Editor, WORLD OIL, P. O. Box 2608, Houston 1, Texas

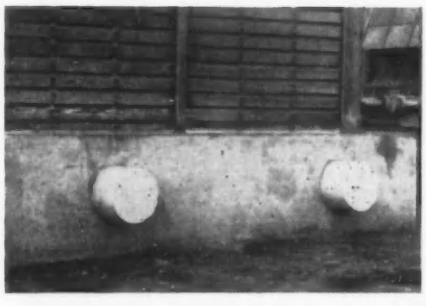


Glass Holders Protect Charts

Individual glass and pressed wood holders for tank charts which fit snuggly inside a small cabinet, can save charts and storage space too.

The individual holders are made as shown in the accompanying drawings. The chart fits under the rectangle of window glass which in turn fits under clips attached to a pressed wood sheet. This sheet has hinges as shown and a 17-inch-long ½-inch angle aluminum for a stop.

The cabinet is made of pressed wood and white pine. Grooves in the white pine sides form keyways for the individual charts. Stops limit the distance the charts can be pushed inside the cabinet and the distance they can be withdrawn. When the chart is pulled out the hinges let it fall to a vertical position for easy reading.



Pipe Provides For Tower Expansion

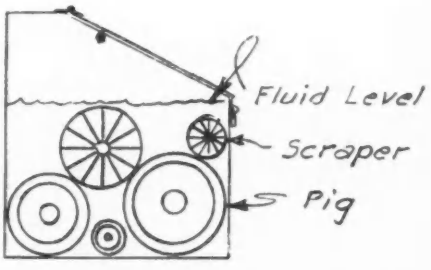
Future cooling tower expansion can be simplified if short lengths of 16-inch pipe are poured as integral parts of the cooling tower wall. The pipe is capped with light gage plate and when another cooling tower bay is added to the existing tower, the caps can be removed to connect with the additional bay. This leaves the concrete wall which supports one end of the tower intact, saving the expense of providing structural support.

Since cooling basin walls are seldom more than eight-inches thick, there is insufficient bondage between pipe and concrete to prevent leakage. This condition is emphasized by the temperature of the water, which may run to 80-90° F. Solution of the problem is to add a four-inch flange around the outside of the pipe and set it at mid-point in the wall.

Slogans Printed On Drinking Cups

Here's a simple idea, but a good one. Why not print safety slogans, requests for blood donations, etc., on drinking cups. This would be effective and likely less expensive than the usual flood of poster material found around pump and compressor stations. The slogans could be varied in colors, and each one could have a semblance of individuality. This method of advertising safety, etc., would be particularly effective on construction jobs.

The cost would run about 10 percent greater than the original cost of the cups.



Storage Vats Can Check Corrosion

Store pigs or scrapers in vats or tanks filled with sweet crude or neutralizing solution to eliminate expensive corrosion, which often destroys brushes and sometimes the bodies of pigs in the time between runs in sour crude.

If sour crude is left on the pig, it continues to attack the metal parts. The brushes of high carbon steel quickly corrode and their cost alone is high—running something like $20 for brushes for a 12-inch pig. Cost of other parts run higher.

By using a storage vat between runs, the brushes and parts can be saved from corrosion. The vat can be made of various materials and can be any convenient size, depending on size of the pigs to be stored in it.

How to keep a "Main Line" on schedule!

GAS main lines are increasingly in demand today for city gas distribution. And delivery of line pipe *on schedule* is essential to expedite new installations.

A large share of Kaiser Steel's medium diameter line pipe is used in city distribution lines—all of it delivered *on time.*

This same dependable delivery is available to users of line pipe in the western two-thirds of the United States.

Add to this Kaiser Steel's *uniform quality* and *wide range of sizes* and it's clear why—

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KAISER STEEL PIPE SPECIFICATIONS • All pipe manufactured to latest A.S.T.M. and A.P.I. specifications

Type	Diameter	Length	Wall Thickness	Shipping Point
Continuous Weld—Threaded and Coupled	½" to 4" nominal I.D.	Uniform 21'	Standard	Fontana, Calif.
Continuous Weld—Plain End	2⅜" to 4½" O.D.	Up to 40'	Standard	Fontana, Calif.
Electric Resistance and Fusion Weld—Plain End	8⅝" to 20" O.D.	Up to 40'	.188" to .500"	Napa, Calif.—Basalt-Kaiser
Electric Resistance Weld—Plain End	5⅝" to 12¾" O.D.	Up to 55'	.188" to .375"	Fontana, Calif.
Electric Fusion Weld—Expanded—Plain End	22" to 30" O.D.	Up to 40'	.188" to .500"	Napa, Calif.—Basalt-Kaiser

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Whether your next job will be similar to the one illustrated above—laying pipe through open water, or through rivers or marshy ground, WATE-KOTE will do the job better.

WATE-KOTE is the high-strength, high-density weighting material developed by Rosson-Richards to lick the toughest weighting problems at minimum cost. WATE-KOTE is not only the heaviest weighting material of its type yet developed, but is tough enough to take a lot of punishment during laying operations.

WATE-KOTE is uniformly reinforced with Key Mesh Wire or Single Strand Wire to provide an adherent material almost as strong as the pipe itself.

Key Mesh Wire Reinforcement

Single Strand Wire Reinforcement

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Stand Provides Portable Meters

A three-inch pipe welded to the framework of a portable meter house, provides a base for meter stands. The house can be loaded onto a "bob-tailed" truck with the meters in place.

The two-inch meter stands clamp to the three-inch pipe as shown. Connections to the nearby pipe line meter-run come through holes in the wall of the house.

When it is necessary to move the house, the mercury can be removed from the flow meters, the unions disconnected and the house can be winched onto a truck.

Gabled Markers Aid Air Patrol

A gable-type sheet metal roof, supported above the gear housing of a main-line valve by a light metal frame aids the pilot whose job it is to patrol the line from the air. Each side of the miniature pitched roof is 30 x 36-inches and is painted orange. The

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Whatever the size or location of your next job, give Rosson-Richards a call. You will benefit from their experience and ability to do the job right.

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WALWORTH TYPE 49 CAST STEEL GATE VALVES

Designed on the through-port principle . . . body and disc ports are accurately indexed . . . body ports bored to match connecting piping . . . no obstructions to interfere with free flow of liquid or the passage of pigs or scrapers . . . no recesses to accumulate dirt . . . no internal lubrication required. These valves may be installed without regard to flow direction. Sizes: 2 to 30 inches, inclusive. Series 400 and 600 for working pressures up to 1440 pounds per square inch.

Walworth 30-inch, Type 49, Cast Steel, Pipeline Gate Valve installed in a gas line.

Walworth 24-inch, Cast Steel, Lubricated Plug Valve on discharge line in gas booster station.

WALWORTH LUBRICATED PLUG VALVES

Features include: quick opening and closing with quarter-turn of plug . . . no threaded stems or complicated seating mechanisms . . . plug is always seated in the body . . . foreign matter cannot wedge between seating surfaces . . . lapped surfaces of both plug and body, plus lubricant seal, assure tight, leakproof closure. Made of steel, iron, bronze, or special alloys. Sizes: ½ to 30 inches, inclusive. Working pressures: 125 to 5,000 pounds per square inch.

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Both the Walworth Type 49 and the Walworth Lubricated Plug Valves have many more outstanding features. Ask your Walworth distributor to tell you about them or write Dept. 07 for illustrated circulars.

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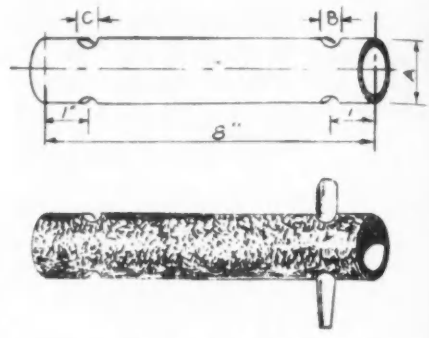
numerals are black.

This device is of great help to the pilot whose job it is to report anything he notes from the air that is out of the ordinary on the pipe line right-of-way. It enables him to pinpoint exact locations of trouble much better than if the valves were not numbered. Also, it is a navigational aid to him in his pipe line patrol.

The main-line valves are numbered consecutively along the line. The markers are made of sheet metal tacked to a triangular frame which bolts on directly to the valve. Holes drilled in the one-inch angle iron permit the marker to be mounted on the valves in a few minutes. They can be demounted just as easily.

Rubber Handle Protects Hands

A handle made from radiator hose can save fingers and thumb by holding center punches, chisels, etc. This handle is made of stiff radiator hose, with holes of different sizes drilled at



opposite ends. To use, simply insert the tool inside the small holes. This will protect the fingers from an accidental blow from a hammer or maul.

Cut eight-inch lengths of 1⅜ and 1⅝ O. D. radiator hose; one inch from either end drill holes sized as follows:

	Small Handle	Large Handle
A	1⅜	1⅝
B	⅜	⅝
C	½	⅞

The cast of these "precaution for safety's sake" tools is about 50 cents each.

PIPELINE COMPLETION "DEADLINES?"

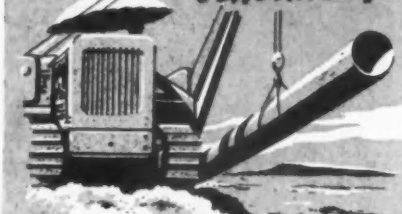


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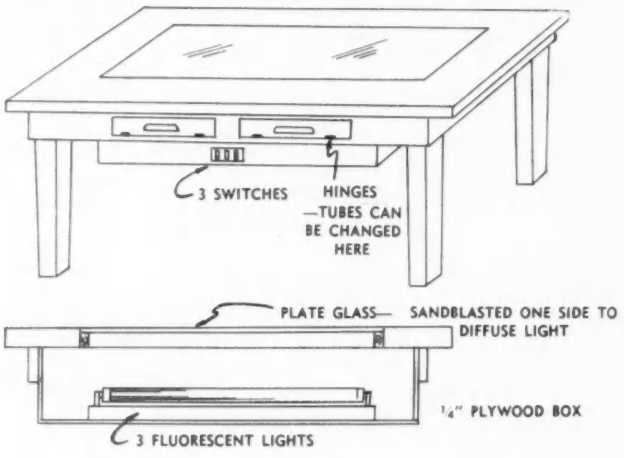
Table Converted to Tracing Surface

An old conference table was converted to a light table for tracing drawings at a cost of about $30. After conversion, the table still retained its usefulness as a conference table.


3 SWITCHES
HINGES —TUBES CAN BE CHANGED HERE
PLATE GLASS— SANDBLASTED ONE SIDE TO DIFFUSE LIGHT
¼" PLYWOOD BOX
3 FLUORESCENT LIGHTS

The window in the table was made from a 24 x 48-inch piece of heavy plate glass. The glass was sand blasted on the underside so light passing through it would be diffused.

A box made of quarter-inch plywood was attached underneath the table top to house the lighting after the drawers were removed. The inside of this box was painted a flat matte white to reflect and diffuse the light evenly. Hinges were added to the face of the drawers so they could be opened to change lights.

Three 48-inch fluorescent lights were installed in the box and connected to separate switches. This enables draftsmen to vary the brightness of light beneath the glass.

Unitized Anchor Bolts Save Time

Time can be saved in pouring footings by pre-assembling the anchor bolts on a board template, then adjusting them as a single unit at the time concrete is poured. This device is particularly useful when a number of footings, all of them of similar dimensions, are to be poured at one time.

When the spacing of anchor bolts is determined, holes should be carefully bored at proper intervals in a one-inch board template, the latter of such length that it will just fit inside the top of the form to assure alignment. The bolts are attached to the board by equipping each with two nuts, one above and one below the board, and tightening them down after the desired amount of thread is left on each of the bolts.

Mounted in this manner, the anchor bolts are adjusted easily, plumbed and accurately positioned when the concrete is poured around them. Once positioned, and after the cement has partially set up, the top nuts are removed and the board is taken off for use on another form.

Handy Strainer Made of Scrap

An easy-to-clean strainer for a small centrifugal pump can be inexpensively made of scrap materials. The purpose of the strainer is to keep trash out of the pump housing of a sump pump. The principle of the strainer is simple: For a 1½-inch pump, divide a short length of four-inch pipe by a screen which fits into a raceway made of keystock. Weld a collar of 1½-inch pipe into a circle of ½-inch steel plate which blinds one end of the pipe. Saddle another

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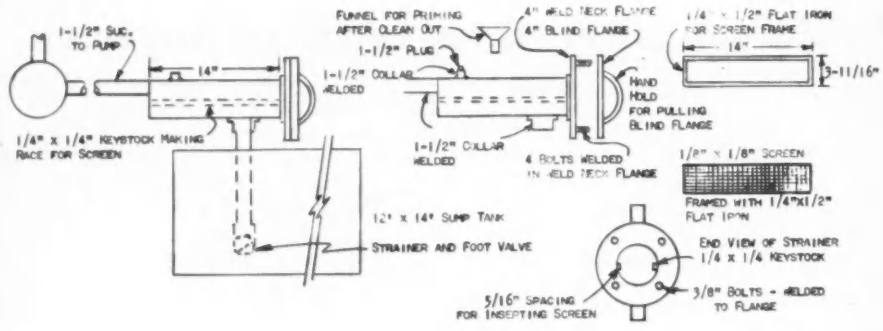

1-1/2" SUC. TO PUMP
14"
1/4" x 1/4" KEYSTOCK MAKING RACE FOR SCREEN
FUNNEL FOR PRIMING AFTER CLEAN OUT
1-1/2" PLUG
1-1/2" COLLAR WELDED
4" WELD NECK FLANGE
4" BLIND FLANGE
HAND HOLD FOR PULLING BLIND FLANGE
1-1/2" COLLAR WELDED
4 BOLTS WELDED IN WELD NECK FLANGE
12" x 14" SUMP TANK
STRAINER AND FOOT VALVE
1/4" x 1/2" FLAT IRON FOR SCREEN FRAME
14"
3-11/16"
1/8" x 1/8" SCREEN
FRAMED WITH 1/4"X1/2" FLAT IRON
END VIEW OF STRAINER
1/4 x 1/4 KEYSTOCK
3/8" BOLTS - WELDED TO FLANGE
5/16" SPACING FOR INSERTING SCREEN

collar onto the four-inch pipe as shown. Then weld a flange onto one end of the four-inch pipe.

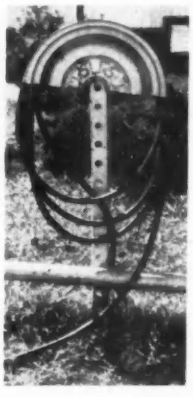
To fix the screen in place weld two ¼ x ¼-inch pieces of key stock about mid-point on the inside of the four-inch pipe. Fabricate a frame for the screen from light steel strap, and cover it with ⅛ x ⅛-inch screen.

Then slip it inside the four-inch pipe, underneath the two lengths of keystock. Over the open end, bolt a blind flange; this will hold the screen in place. All oil from the sump will have to pass through it or around it. If the frame is fitted carefully, very little fluid will go around the screen.

To clean, simply remove the blind flange, pull out the screen, and start cleaning. After the screen has been cleaned and replaced, the strainer is primed through a coupling welded in top of the four-inch pipe.

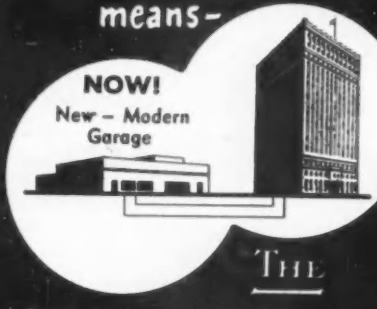
Old Auto Wheel Used as Rack

An inexpensive hose rack for pump station use can be made by cutting an old automobile wheel in half, and welding it to a stand made of angle iron.



Condition of lawn is important at pump stations inasmuch as it reflects the general level of "housekeeping" so vital to station maintenance. This handy rack protects the hose necessary for green lawns.

Business and Pleasure in TULSA means-



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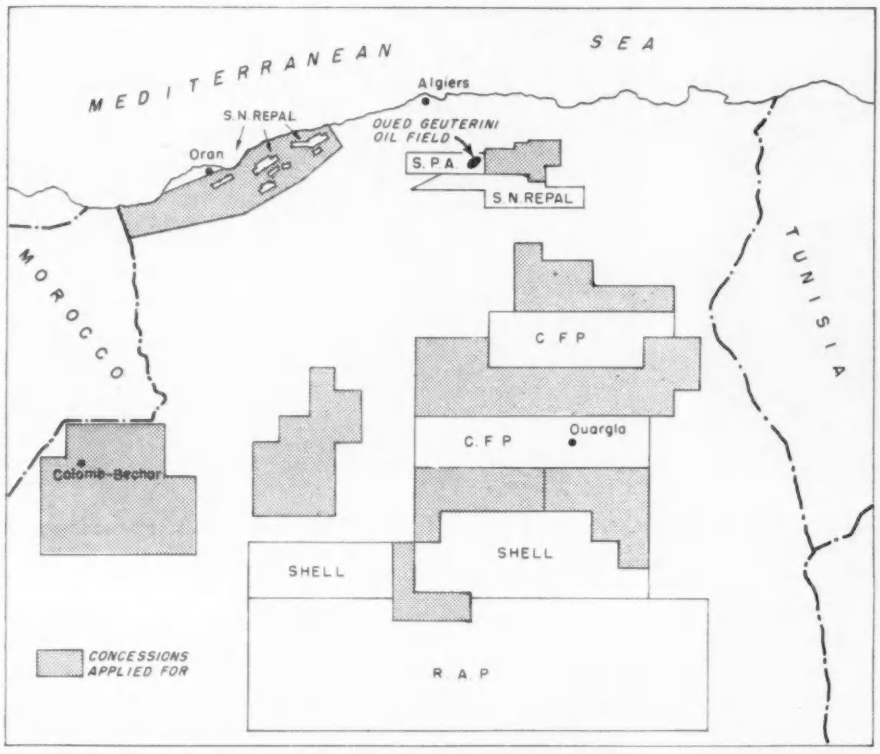


Concessions in Algeria

Oil in Algeria

Shell's entrance into exploration picture and boost in production by S. N. Repal draw attention.

By DR. J. BRIAN EBY
Special WORLD OIL Representative

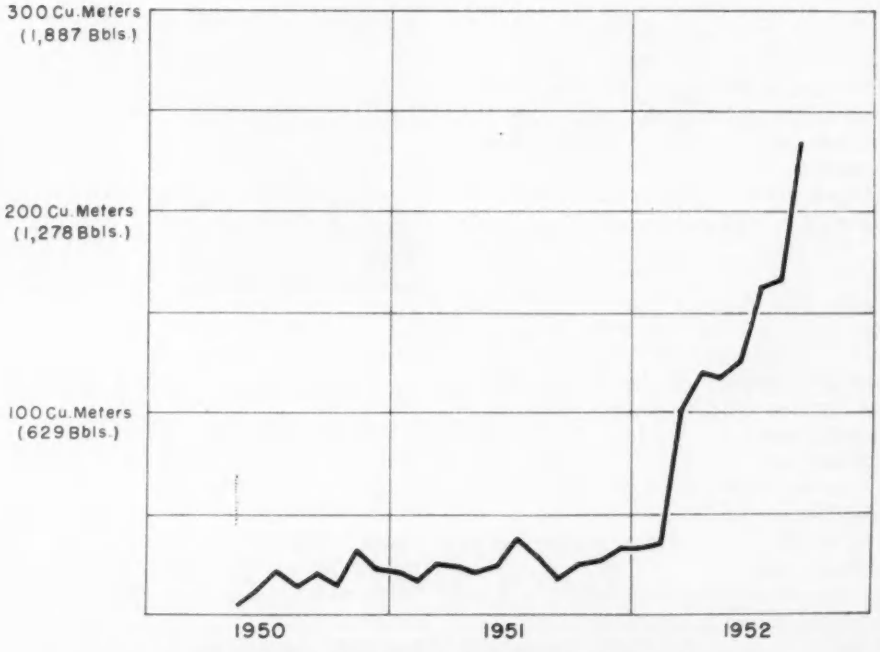
THE ENTRANCE of Shell Oil Company into the Algerian oil exploration picture and the quadrupling of daily oil production within the last six months by S. N. REPAL, the French controlled oil company operating the only producing field in the country, draw international attention to the oil possibilities of this region. The Societe Nationale de Recherche et d'Exploitation des Petroles en Algerie, commonly called S. N. REPAL, was organized in 1946 for the exploration for oil in Algeria. It is controlled entirely by French and Algerian government capital, bearing in mind Algeria is, administratively, part of the continental French homeland. They hold about 86,890 square miles of concessions, principally in the north half of Algeria. Armand Colot is general manager and Michei Tenaille is manager of operations.

Shell's concessions cover about 93,000 square miles south of REPAL's holding and in the Algerian Sahara desert region, south of Ourgla and north of In Salah. Another French company, Regie Autonome de Petroles, called RAP, which also owns and operates the Saint Marcet gas field in Southern France, has taken a still larger concession contiguous to and south of the Shell's lease. They have acquired more than 149,000 square miles of South Algerian Sahara desert country, in the general region of In Salah. The Shell concession will be operated by Cie. des Petroles d' Algerie, in which Shell will own 65 percent and Regie Autonome des Petroles and Bureau de Recherches de Petrole will own 35 percent interest.

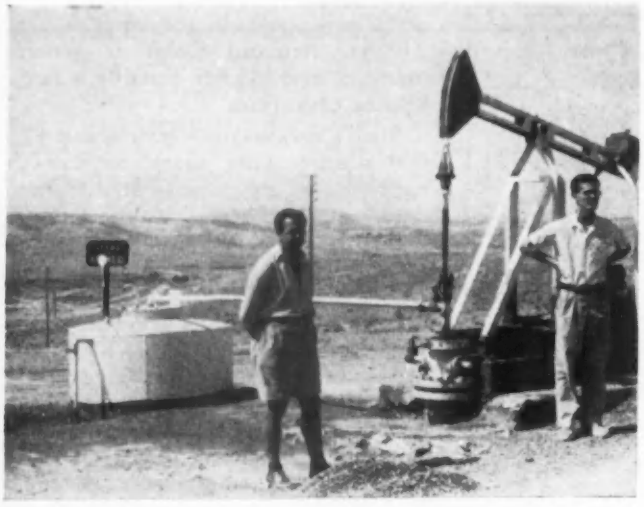
No Ownership Restrictions

There are no restrictions on foreign ownership of concessions in Algeria. Inquiries concerning them should be sent to the Director of Industry, Trade and Energy, the Government General, at Algiers. Partnership with a French (Algerian) group is not mandatory but would be helpful. Any responsible oil company or group are welcome to do reconnaisance geology before applying for concession.

The Standard Oil Company of New Jersey carried out 18 months of geologic work in 1949 and 1950 but did not ask for a concession. No money or bonus is required for concession



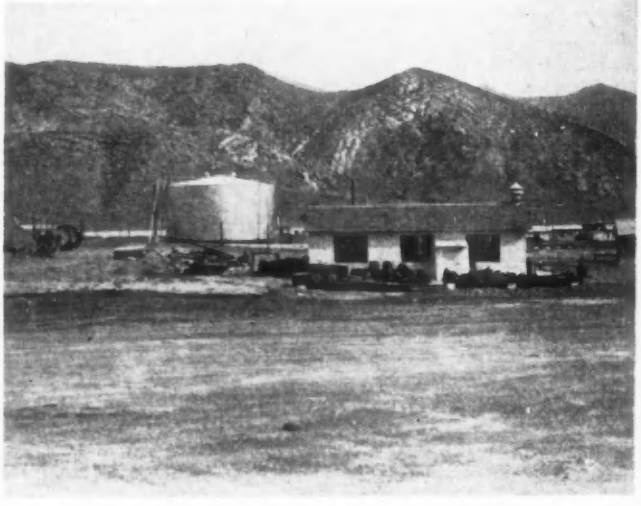
Daily Production of Oued Gueterini Field



Gathering tank for well in foreground. Note float gauge on intake tank to left. Left is Prof. Miloche N. Pavlovitch, Belgrade, and, right, A. K. Miller, from Emory University in Georgia.

Arab graveyard 10 miles west of Sidi Aissa. Rocks of Triassic age in background.

In the foreground, three-inch pipe line that runs from Oued Gueterini field to Sidi Aissa. J. W. Butler, Phillips Petroleum Corporation, Caracas, Venezuela, surveys scene.



This is Sidi Aissa, collecting point for oil from Oued Gueterini field.

coverage, but responsibility and performance are the salient features. Personal contact with the proper authorities in Algiers is necessary for a complete understanding of the situation. The present director of the Department of Industry, Trade and Energy is Salah Bouakouir.

The single producing oilfield of Algeria is Oued Gueterini (formerly called Sidi Aissa); located eight miles northwest of Sidi Aissa and about 70 miles southeast of Algiers on the southern border of the Tellian Atlas mountains. To the south extends the broad, semi-arid plain of Hodna, treeless, and cultivated only where rivers or water holes permit. A few small Arab settlements are found to the south along with a scattering of nomad tents.

The oil field was discovered in 1949 and at present is producing 1400 barrels daily from 57 wells. The oil is black, paraffin base, and 38.9° A.P.I. gravity. It is pumped through a 3-inch line to Sidi Aissa and there loaded into tank trucks for Algiers and transportation to Shell's Berre refinery in France. There are 1100 acres of proved production. Oil seepages in the banks of Oued Gueterini were known to the Arabs long ago, and they used the oily muds to salve their camels' sores.

Colot

Leca

Tenaille

Officials of S. N. REPAL: Amand Colot, general manager; M. Leca, technical director, and Michel Tenaille, manager of operations.

Igor Ortynski, chief geologist for South Algeria for REPAL, and Petroleum Engineer J. Puech presented a paper on the field at the 19th Geological Congress and pointed out the complexity of the oil field structure. The production comes from two zones in the lower Eocene at depths of 1920 feet and 3070 feet on the average. The oil occurs in lenses of coarse

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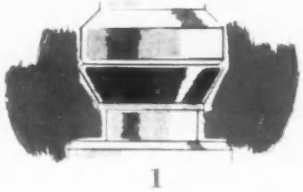
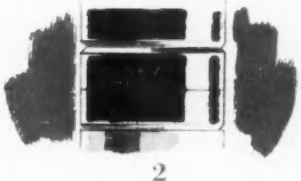


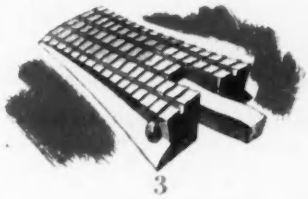
1

This valve seal, on Lane-Wells valve-type packers, seals securely **under** 10,000 lbs. differential pressure, even at 300°F., and *even with* trash on the seat!



2

The special design and material of Lane-Wells packing elements give a *controlled* expansion which insures leak-proof packoff, even under extreme pressures and temperatures. These packing elements do *not* "vulcanize" to the casing, but spring back to practically original size for easy pulling and longer life.



3

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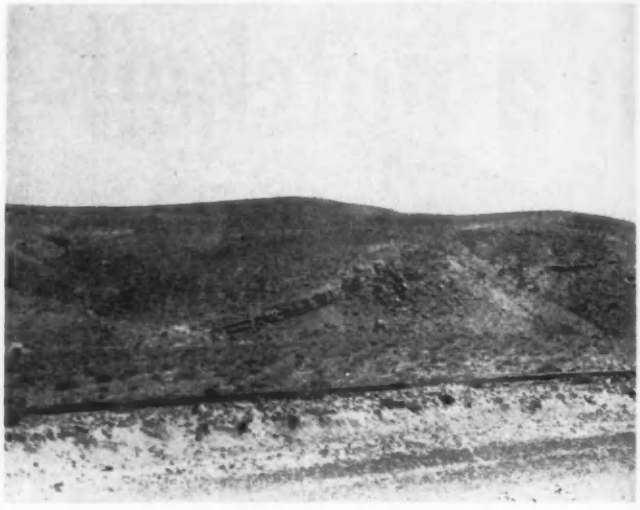
AP-509

Bj Baniou, a tiny oasis village, near Bou Saada. Note flat salt lake basin, the Chott el Hodna.



Oued Gueterini scene with Miocene rocks in background, three-inch pipe line in foreground.

Drilling rig in Oued Gueterini field.

grained phosphatic limestone of low porosity, from 5% to 25%, and very low permeability. Saturation depends on a system of fractures, and wells vary accordingly, with initial flows from a few barrels to 500 barrels a day.

The subsurface is extremely complicated by the occurrence of numerous laminated thrust sheets of Miocene beds over and on Cretaceous rocks. In the oil field there are at least five of these overthrusts interbedded by Eocene strata including the oil horizons. The topmost of these overthrust sheets has been eroded by Oued Gueterini (a creek) into a "fenetre" (window) exposing the oil seepage. These dislocated strata are called "nappes" by the French geologists. A Triassic nappe outcrops in the ridges north of the field. The source of the force of these thrusts is from the north.

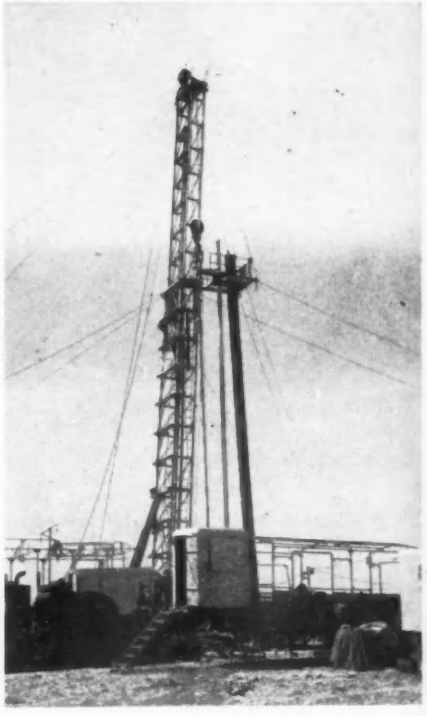
The oil field and vicinity is being operated on an independent concession, owned by Societe des Petroles d' Aumale, called S.P.A., under the presidency of Amand Colot, who is also general manager of S. N. REPAL. S.P.A. is owned 50 percent by the French (Algerian) government and 50 percent by private capital. Pierre Lasnier is drilling superintendent and A. de Spengler, district geologist.

The company has eight rigs in operation. In 1951 they drilled approximately 100,000 feet of hole, about 60 percent of which was for wildcatting. Drilling for 1952 will probably exceed this figure.

Labor is locally hired and the native Arab makes a satisfactory worker. Many Algerian French are engaged in various capacities and quite a few of the younger technicians come from France for training and experience.

The Oued Gueterini oil field has produced to Aug. 1, 1952 a total of 246,000 barrels of oil. Most of this was in the year 1952. Predictions as to proved reserves are not sufficiently crystallized to put in print at this point. The upper zone of production ranges from 26 to 40 feet and the lower zone from 200 to 330 feet. The real source rock or "mother" pool has not yet been located. Spacing of wells is random at present, geologic advice governing the location of wells.

The general process of oil exploration in Southern Algeria is first a critical examination of aerial photographs. Practically all the northern part of country has been covered by military photography most of which is available to responsible groups. Oil

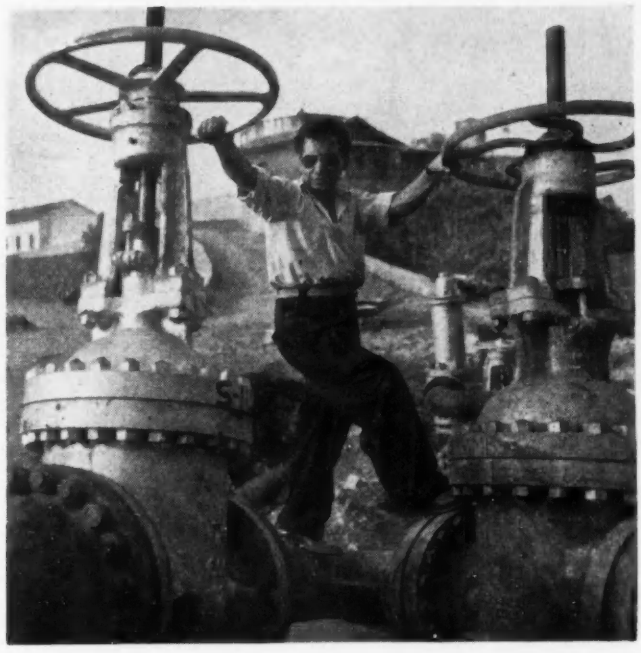


Drilling rig in Hodna Basin.

seepages are rare but important markers. The barren rocky phase of the Sahara desert topography and the Atlas mountain ranges and foothills present many excellent geologic surface markers.

Geophysics follows the routine pattern, gravity, the magnetometer (ground and airborne), reflection and refraction seismograph. Much interest lies in the sand dune topography of the Sahara desert. It is believed that refraction seismograph will be the answer here. Preparations are now being made to send geophysical crews into this territory and the solution to the problem is awaited with anxious anticipation.

Mexico Speeds Work On Crude, Gas Lines



These are control valves for Poza Rica-Atzcapotzalco crude line on which expansion work is scheduled to begin. Present capacity of line is 50,000 barrels daily. Goal: 80,000 barrels a day.

Since 1946 Pemex has constructed more than 1000 miles of crude, products, gas pipe lines; 500 more miles are approved or underway.

PETROLEOS Mexicanos, Mexican government oil company, is speeding work on crude, products and natural gas pipe lines in current and projected construction programs designed to adequately handle the present production potential.

This program is a follow-up to pipe line expansion already completed, particularly during the past two years. Two years ago, Mexico's most urgent supply and distribution need was to move more crude from the Gulf Coast to the high central plateau for refining in an area of major consumption. This area is situated northwest of the Mexico City's refinery supply orbit.

Pipe Line Built

So a 278-mile pipe line was constructed to take Poza Rica crude to the new Salamanca refinery in Guanajuato State, about 180 miles northwest of Mexico City. That left, as the next most urgent problem, the need to supply West Coast points with more Mexican-refined products. Pending construction of the projected West Coast refineries, a products line across the Tehuantepec Isthmus brought relief. Completed in 1951, that 155-mile pipe line effected savings in rail transport, eliminated the lengthy tanker haul through the Panama Canal and reduced import requirements. When the proposed refineries are erected, the pipe line will be converted to crude shipments.

And now, to obtain a more efficient distribution from Salamanca refinery, a network of crude products lines from it is underway.

A contract has been let for construction of an eight-inch, 20,000-barrel daily pipe line from Salamanca through Irapuato and Leon to Lagos de Moreno, in Jalisco State. Estimated cost is $1.4 million, including terminals. With Mexican pipe available, completion date has been set for October of this year.

From Lagos de Moreno, two 6-inch lines each with a capacity of 10,000 barrels daily will branch out, one extending 122 miles southwest to Guadalajara and the other 53 miles northwest to Aguascalientes. Mexican pipe has been ordered for these lines, and final engineering work on the routes is under way.

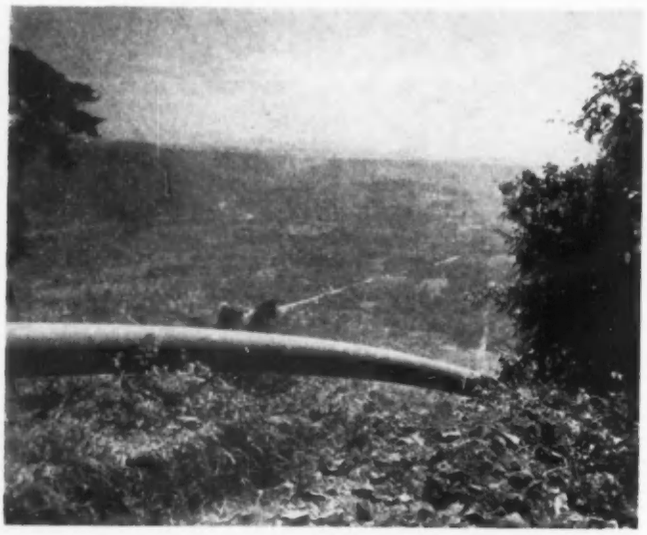
Another line, direct from the Salamanca refinery south to Morelia in Michoacan State is projected. Preliminary cost estimates for all Salamanca products lines approach $4 million.

Also in the planning stage is a 340-mile, 10-inch, 15,000-barrel-a-day products line from the Tampico refineries to Monterrey.

Gas Available

Of current paramount concern to Pemex is to make abundant natural gas of Reynosa, Brasil and other fields in Northeast Mexico available to Mexican industry on a wider scale. Monterrey, Cementos Hidalgo and Matamoros are being supplied, and the Monterrey-Torreon pipe line is under construction. A 25-mile section of 12-inch pipe at the Torreon end has been completed. The remaining 186 miles is being built of 16-inch pipe, with 37 miles of line pipe available in Mexico and the remainder awaiting delivery from the U. S. Estimated cost of the 100 Mmcf daily line is $4.1 million.

Two other natural gas pipe line



Pipe line construction in Mexico is rough going in many sections (left). In building Poza Rica-Salamanca line, 12-inch line ascended 8700 feet within distance of 70 miles to get over hump of Sierra Madre Oriental Mountains. This is section descending into Huauchinango Valley in northern Puebla. Here a machine aids in coupling job (right) as Mexico spurs its pipe line program forward.

projects which have high priority in Pemex planning are:

- A 20-inch 133-mile, 150 Mmcf daily natural gas line from Reynosa to Monterrey. Pipe for this project will be acquired in Mexico and the U. S.
- A natural gas pipe line south from the northeastern fields to supply Tampico and other cities en route to Poza Rica, where it will supplement the supply of that field.

Poza Rica now produces 135 Mmcf daily of natural gas from which the Mexico City area is supplied through a 20-inch pipe line built in 1948. About 28 Mmcf is used daily in repressuring operations at Poza Rica. The Reynosa-Poza Rica gas line will be 415 miles long and will have a daily capacity of 150 Mmcf.

Pemex's single crude oil line now under construction will move production from the new Jose Colomo field in Tabasco State to terminal facilities at El Plan in southern Veracruz. This 10-inch line will be 118 miles in length and have a daily capacity of 25,000 barrels. Mexican pipe is being used.

The initial 37 miles of the $1.5 million pipe line has been contracted. Pemex expects the line to be completed in December.

Work Scheduled

Improvment work is scheduled to begin on the 147-mile, 10-inch Poza Rica-Mexico City crude pipe line. Some pipe in the line is almost 20 years old and shows signs of corrosion. Approximately 80 miles will be looped with 12-inch pipe, making possible the delivery of a larger volume of Poza Rica crude to the Atzcapotzalco refinery for a planned future capacity of 80,000 barrels daily. Average crude runs to stills now is about 47,000 barrels daily.

Present capacity of the pipe line is 50,000 barrels a day. Its increased capacity will be 80,000 barrels daily.

Pemex has scheduled the expansion of the Poza Rica-Salamanca crude line capacity in 1953 from 30,000 barrels to 50,000 barrels per day. Additional pumping equipment will be acquired from the U. S.

Since 1946, Pemex has built more than 1000 miles of oil and gas pipe lines, and projects now underway or approved for construction add up to almost 1500 miles.

When ditching operations begin, the men watch.

When trucks bog down, manpower is required.

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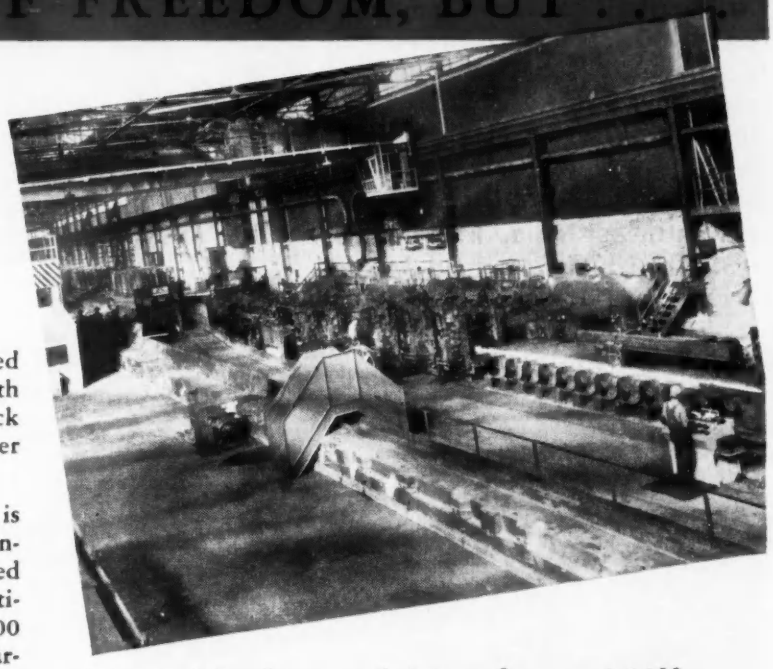
Urged on and on by the incentives afforded by our free enterprise system—Americans, with the private money of thousands of stock holders, have built a Bulwark of Steel greater than all the rest of the world.

The capacity of America's steel industry is so great that in 24 hours, it can turn out ingots and castings sufficient to provide finished steel for—500 airplanes, 500 tanks, 1,000 anti-aircraft guns, a half million 3-inch shells, 1,000 howitzers, 2,000 aerial bombs, 1 aircraft carrier, 2 heavy cruisers, two cargo ships, two tankers, 1,000 freight cars, 2,000 trucks, 12,000 automobiles, 20,000 refrigerators, 20,000 stoves, 2,000 homes, and still have 23,000 tons of steel for other purposes.

Remove the incentives of free enterprise or burden it with excessive restrictions and our magnificent steel industry will be vulnerable to the wasting erosion of socialistic rust.

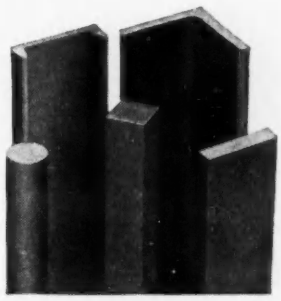
SHEFFIELD STEEL CORPORATION
HOUSTON KANSAS CITY TULSA
SUBSIDIARY OF ARMCO STEEL CORPORATION



Most Modern of Merchant Mills

On this highly mechanized 12-inch merchant mill, steel billets are more efficiently rolled into a wide variety of merchant shapes and sizes vital to manufacturing.

It is a typical example of the continuing modernization and expansion program of Sheffield Steel which, in the last ten years alone, has more than tripled the at-home steel making capacity of Sheffield Steel mills. New furnace and blooming mill capacity now under construction will enable Sheffield Steel to continue to pace industrial progress with an ever increasing supply of steel—the vitamin A of industrial growth.



SHEFFIELD MERCHANT STEEL

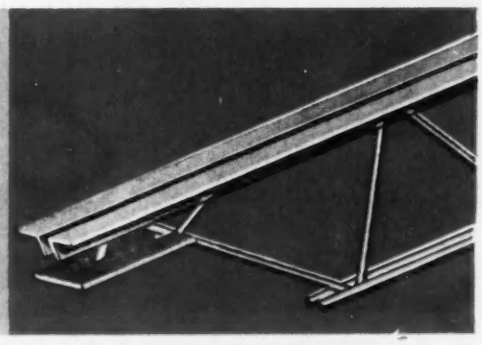
There are few industries that do not use merchant steel. Sheffield Steel mills roll a wide variety of bars and shapes.

SHEFFIELD

STEEL PRODUCTS OF ADVANCED DESIGN FOR MODERN CONSTRUCTION

The patented crescent shaped deformations of Sheffield Crescent Reinforcing Bars increase the bond of concrete to steel—contribute to economies in both design and construction.

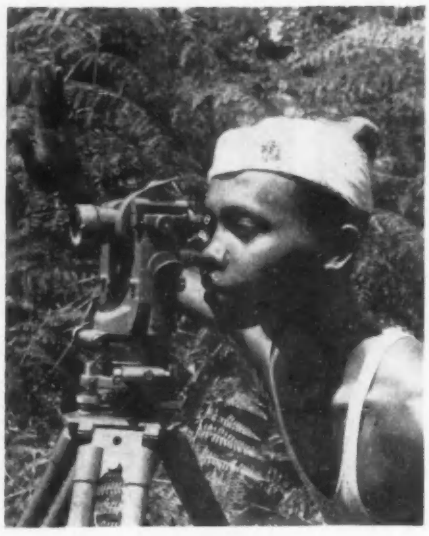
The design and construction of Sheffield Steel Joists makes possible the supporting of more floor or roof area per ton of material in many types of structures.



Sheffield Products: Carbon and Alloy Steel, Ingots, Blooms, Billets, Plates, Sheets, Hot Rolled Bars, Steel Joists, Structural Shapes, Reinforcing Bars, Welded Wire Mesh, Wire Products, Wire Rods, Fence, Spring Wire, Nails, Rivets, Grinding Media, Forgings, Track Spikes, Bolt and Nut Products

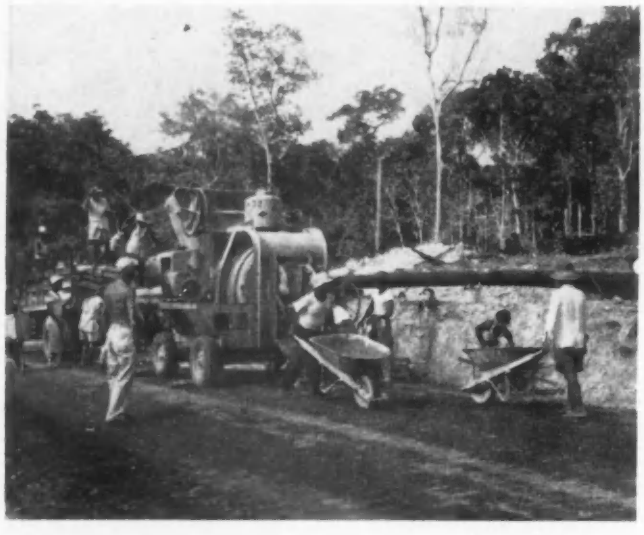
Jungle Oil

Sumatra's Minas field crude, developed and produced by Caltex Pacific Petroleum Company, an affiliate of Standard Oil Company of California, is supplementing oil from other areas in meeting crude demands from Australia, New Zealand, Japan, the Philippines and countries of Southeast Asia. But there's a colorful history behind Minas crude which began when . . . .

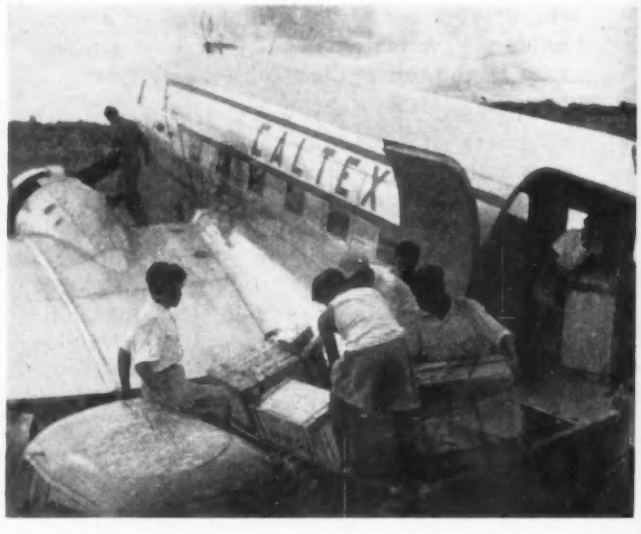


1 Native surveyors helped lay out roads in jungle.

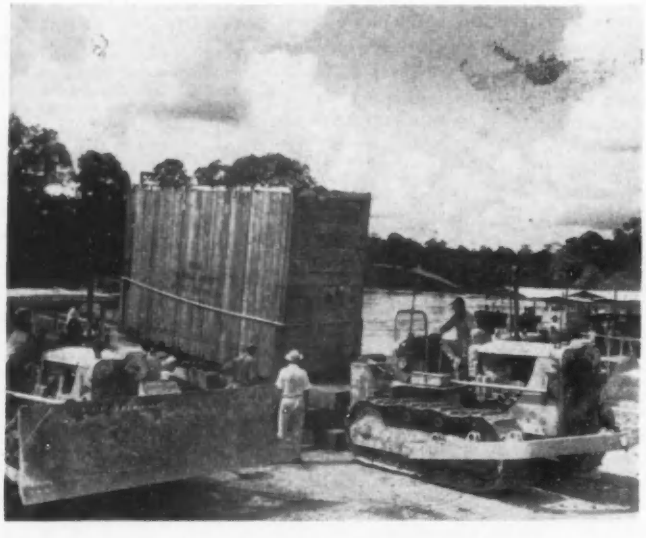
2 Indonesian woodcutters took over to clear path.



3 Once cleared of undergrowth, oil was poured on roads, enabling other work to proceed.



4 After a network of roads was built, supplies poured in by air from Djakarta and Singapore.

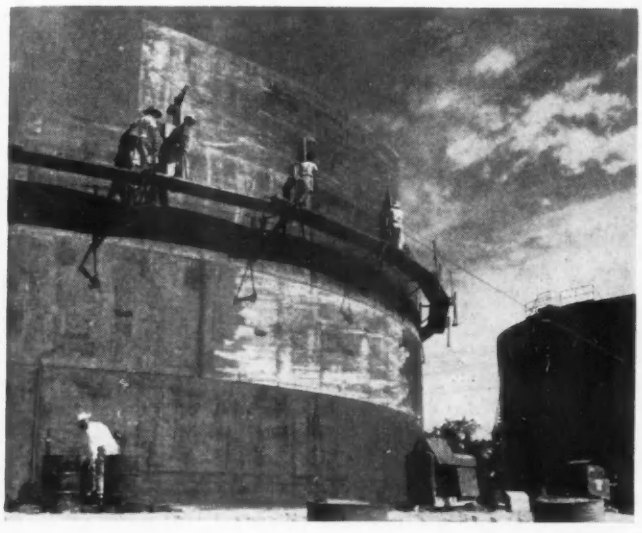


5 Equipment such as this 50-ton diesel was delivered by water to Caltex's Rumbai terminal.

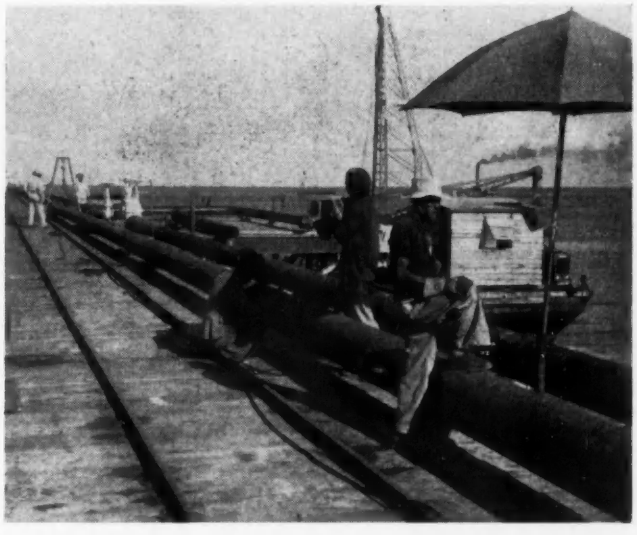
6 From the terminal, a bulldozer took diesel engine driver to Minas central pump station.

7 Work on Minas field rig no unpleasant task to this native.

8 Once found, new oil must be moved. Here a side-boom tractor helped out on new 12-inch, 17-mile pipe line which connects Minas and Perawang terminal on Siak River.



9 A 55,000-barrel tank was built at Minas field central pump station for storage.



10 Port facilities were built and cycle was completed when valves at Minas station were opened to send Sumatra oil to Asian markets.

11 While oil field installations were being built, housing facilities were constructed. This is the bachelors' quarters at Caltex Rumbai camp.

12 So organized is the camp that this Indonesian tummyache gets immediate attention.

—Photos Courtesy Coltex.

Three central figures at 19th International Geological Congress were, left to right: Perry Olcott, Houston, chief of AAPG delegation; Luigi V. Cittadini, geologist from Morocco, and D'Arcy Cashin, AAPG delegate.

Dr. Rene Levy, left, inspector general of mines from France, and Prof. D. Jabrev, a member of the exclusive Academy of Science of Soviet Union.

J. W. Butler, Jr., general manager for Phillips Petroleum Company, Venezuela, on the excursion to Oued Gueterini oil field near Sidi Aissa, Algeria.

Lunch stop at Sidi Aissa, field headquarters for REPAL operations. Third from left is Dr. Arthur Benz, German delegate. Prof. Miloche N. Pavlovitch, Yugoslav delegate, is at extreme right.

International Cooperation Marks Geological Congress

Delegates from 77 nations gather in Algiers. Session in 1956 to be held in Mexico.

By DR. J. BRIAN EBY
Special WORLD OIL Representative

WITH THE completion of several field excursions in Algeria and Morocco in October, the 19th International Geological Congress in Algiers passed into history. Several important highlights remain to be recorded. First and foremost was the true international aspect of the Congress, in its membership and the active participation by so many of the world governments. The delegates of 77 nations, including the Soviet Union, in a friendly and scientific meeting, would suggest that world-wide cooperation in other fields of endeavor should not be out of reach.

The French government recognized the value of these meetings by sending one of its cabinet officers, M. Andre Marie, minister of National Education, to Algiers to address the closing session and confer on Professor Charles Jacob, president of the Congress, the medal of Commander of the Legion of Honor. This is one of the highest French civilian awards and a proud distinction for Dr. Jacob.

The invitation of Mexico to bring the 1956 Congress to Mexico City was a pleasant surprise and one that was gladly accepted by the Council and the delegates. The last meeting in America was 1933 in Washington, D. C. Prior meetings were in Toronto, Canada, in 1913, Mexico City in 1906 and the first American session in Washington in 1891.

The excellence of the printed geological maps of North Africa was

Prof. D. Jabrev, right, and A. de Spengler of REPAL, one of excursion directors, chat during one of field trips.

At Sidi Aissa, REPAL headquarters near Oued Gueterini field. At extreme left in dark glasses is Prof. L. Poustovalov, a member of the Academy of Science of Soviet Union.

commented on favorably by everyone. The maps of Algeria and Morocco were especially notable, in the amount of detail shown and fine engraving. It represented a tremendous amount of effort on the part of the local geologists and their organizations.

The Russian delegation was headed by Prof. G. Bogomolov of Minsk, White Russia, and member of the Academy of Science. His second in command was Prof. N. Semenenko of Kiev in the Ukraine and also an Academy member. There were five other members of the Academy of Science of the Soviet Union, all from Moscow. These included Madame Kouznetzova, eminent geologist and faculty member. Two others, Professors D. Jabrev, and L. Poustovalov, were particularly interested in geochemistry and expressed keen interest in the writings of Dr. E. E. Rosaire of Dallas, on this subject. The Soviet group exhibited a film on the completion of the Don-Volga rivers canal which links Moscow to both the White Sea on the north and the Black Sea on the south.

Too much cannot be said for the energy and work put into the preparation for the Congress by such men as Prof. R. L. Lafitte of the University of Algiers and his many associates in the University, government and private companies. M. Tenaille, director of S. N. Repal, planned most of the Algerian excursions and Raymond Levy, chief geologist of Societe Cherifienne des Petroles (S. C. P.) of Morocco, arranged and conducted the trips through that country. The 19th Congress justly merits the rank as one of the best.

A session at 19th International Geological Congress. Left to right are: Governor General M. Roger Leonard, Algeria; Prof. H. Read of England, retiring president of Congress (on rostrum); Prof. R. Lafitte, University of Algiers, secretary-general of Congress, and Prof. Charles Jacob, Paris, France, who was named president of the 19th Congress.

Dr. Ronald K. Deford of The University of Texas, looks out over the harbor at Algiers.

William E. Wrather of the U. S. Geological Survey, Washington, D. C., headed U. S. delegation.

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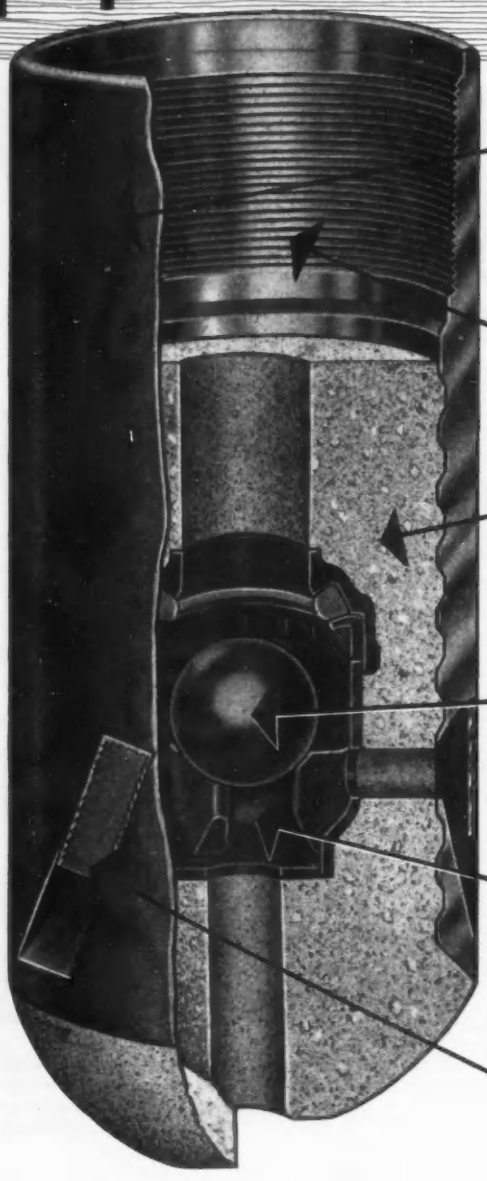

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to fit any style casing

BAKER-FORMULA CONCRETE
and granular plastic —easily drillable

PLASTIC BALL VALVE
to seal instantly against a resilient valve seat

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for hole conditioning and cementing

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whirl the cement slurry and provide uniform encasement of the casing with cement

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Proof that the Baker Cement Wash-Down Whirler Float Shoe (Product No. 120) is "BEST" is evident from thousands of perfect cementing jobs—under every type of field condition. You can easily secure additional proof on your next job.

There are dozens of products in the complete Baker line, ready whenever and wherever you need them—and remember also that Baker Service Engineers are available everywhere to recommend the proper combination to make your *every* job successful. The typical combination illustrated and described on the opposite page, solves many cementing problems—and may be ideal for your next job.

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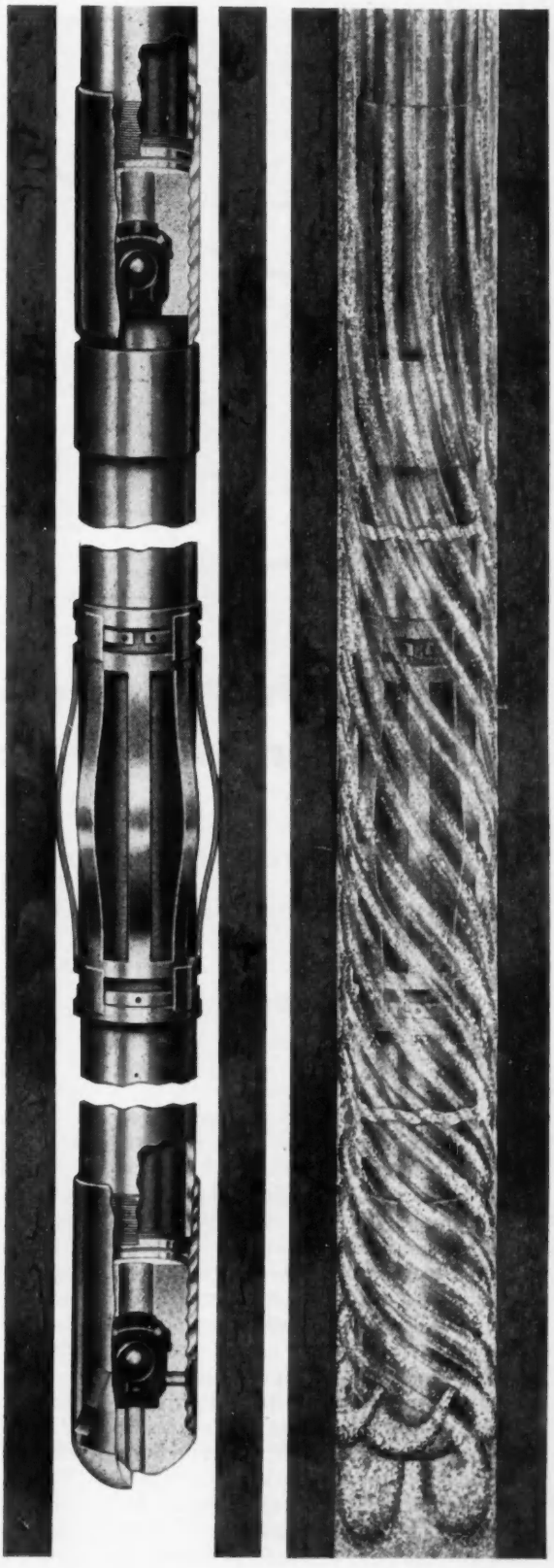
There is nothing "just as good" as *Whirling* ON CENTER

THE DOWNWARD HYDRAULICKING ACTION of the fluid through the baffled, side down-whirler ports of a Baker Whirler Shoe, and through the nozzle-like bottom outlet, effectively removes bridges and permits safe running of the casing.

When washing the formation at the cementing point to condition the hole, the "whirling" motion of the fluid helps remove mud cake from the side walls. This *downward* whirling is far superior to any *side* jetting action.



The view at far right shows the "whirling" motion given to the cement slurry as it is discharged from a Baker Cement Wash-Down WHIRLER Float Shoe, with the shoe joint centered by means of a Baker Model "G" Casing Centralizer. *This same whirling motion given to the circulating fluid, conditions and prepares the wall of the hole immediately prior to the discharge of the slurry.* The whirling action of the slurry, in turn, not only supplements the hole conditioning process, but also ensures that the centered casing will be completely encased with a uniform body of cement and that the hazard of channeling will be reduced to a minimum.

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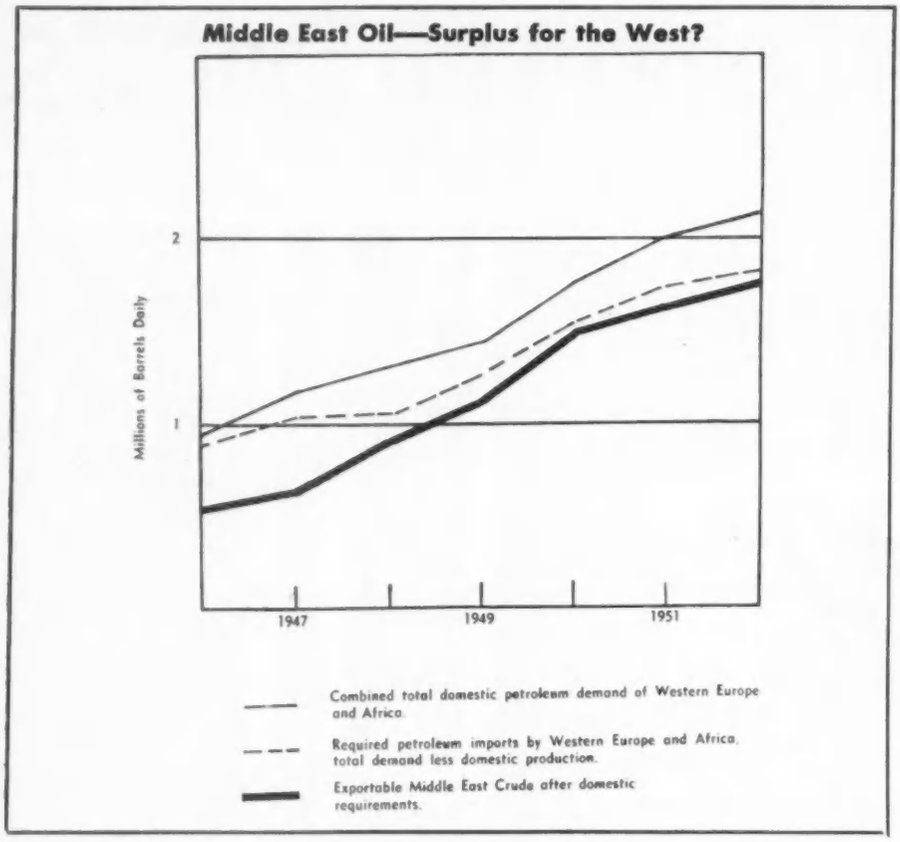
Middle East Oil—Surplus for the West?
Millions of Barrels Daily
2
1
1947
1949
1951
Combined total domestic petroleum demand of Western Europe and Africa.
Required petroleum imports by Western Europe and Africa, total demand less domestic production.
Exportable Middle East Crude after domestic requirements.

Royalty Pacts Increase Oil Flow in Middle East

Here's why the next outlet for this area's great volume of production may be Western Hemisphere.

By ROBERT E. SPANN
WORLD OIL Staff

THE SHIEKDOM OF QATAR is a sandy and rocky desert peninsula jutting out in the Persian Gulf from the Arabian side and slightly smaller than the State of Connecticut. Unlike its neighbors, it is seldom mentioned in Middle East petroleum developments.

It attracted attention recently however, as it became the fourth of the six Middle East oil-producing nations (one of which is now closed in) to be made an equal partner, profit-wise, in its petroleum industry. Highly significant in this latest 50-50 profit-splitting agreement between government and concessionarie is that Qatar (pronounced Gutter), whose first commercial production was in 1949, is an extremely small producer as Middle East production is measured. Qatar's current flow of crude oil is just under 65,000 barrels daily, compared with a daily production of 870,000 barrels in Saudi Arabia, 815,000 barrels in Kuwait and 420,000 barrels in Iraq, where equal division of profit agreements were previously made.

A more lasting importance of the agreement between the Shiek of Qatar and Petroleum Development (Qatar) Ltd. is that, with the exception of Bahrain's small production of 30,000 barrels daily, all of the present Middle East crude output of approximately 2.2 million barrels per day is under the 50-50 profit sharing formula.

Even if Iran's oil never again is made available to Western petroleum markets, production required to maintain profitable Middle East operations under the profit-sharing terms insure that, barring unusual interruptions, a surplus of crude from the region, above requirements of the Eastern Hemisphere exclusive of the Iron Curtain countries, will be available in the near future for Western Hemisphere markets.

The accompanying chart traces the mounting Middle East exportable crude surplus in post-war years in relation to how this production is rapidly closing the statistical gap in total European and African—the nearest markets to the Middle East—required petroleum supply. The Middle East has been the biggest supplier of petroleum to Western Europe and Africa, gradually forcing out Venezuela (the pre-war principal supplier) in the former "sterling" markets.

The combined petroleum import requirements, after allowing for domestic production, of Western Europe and Africa in 1947, for example, amounted to an average of 1,033,400 barrels daily. Total exportable crude production from the Middle East in that year averaged 670,400 barrels per day, or a statistical gap between Middle East supply (in terms of crude) and Western European-African needed outside volume of 363,000 barrels a day. This gap was steadily narrowed to a daily average of 13,500 barrels by 1950, but widened again to 103,800 barrels a day last year when Iranian oil production ceased.

At mid-1952, the difference between the Middle East exportable crude volume and Western European-African combined needs from outside sources amounted to 85,000 barrels daily. Prospects are that by the end of 1952 or early in 1953, the gap will be bridged.

High post-war industrial activity in Western Europe caused demand for petroleum to jump 18 percent in 1950 over the previous year, and last year the gain was 16.5 percent. There is no promise this rate of growth in demand in Western Europe, the principal customer of Middle East oil, will continue.

This leaves the Western Hemisphere, where already a trickle of imported crude from the Middle East is being delivered, as a future outlet for surplus Persian Gulf petroleum. This can currently be delivered on the U. S. East Coast with a price spread, including the new lower tariff, of less than 70 cents a barrel compared with tanker shipments from the U. S. Gulf.

•

Chart data for the first six months 1952 partially estimated. Middle East exportable surplus for 1951 includes Iranian output prior to nationalization. No Iranian production included in 1952.

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Of World Oil Men

WILLIAM H. FARRAND has been elected a vice president of Rainbow Oil Limited, of Alberta, Canada. Ferrand has had 30 years of experience in the oil industry, principally with The Texas Company. He recently was general manager of Texas Company's foreign producing department (western hemisphere) and an officer and director of several affiliated companies.

W. H. Farrand

•

AUGUST SCHNEIDER, former chairman of Verband Schmierfett-Industrie of Germany, has resigned after leaving the firm of Mineraloelwerke Albrecht & Company.

•

DR. WALTER KNUDSEN and DR. CARL SCHMIDT have been elected members of the board of management of Deutsche Vacuum Aktiengesellschaft (Socony-Vacuum) of Germany.

•

WILLIAM A. CLARK has been named as general manager of the foreign producing department, The Texas Company. Clark, who joined the company in 1929, has been in the foreign producing department since 1947. He is vice president of South American Gulf Oil Company and Colombian Petroleum Company, Texaco affiliates, and vice president of Texas Petroleum Company, a wholly-owned subsidiary operating in the Western Hemisphere and West Africa.

William A. Clark

•

C. I. WARREN, assistant land manager, Los Angeles, has been appointed area land manager for Shell Oil Company in Calgary, Canada.

RECENT NOMAD GUESTS of the Houston chapter were, left to right, Curt Summers, C. M. Summers Company, Caracas, Venezuela; J. J. J. Van Wiechen, N. V. de Bataafsche Petroleum Maatschappij, The Hague, Netherlands; W. G. Berry, Z. Z. Export S. A., Caracas; J. J. Progress, Modern Engineering Company, Houston; H. R. Powell, Shell Caribbean Petroleum Company, Maracaibo, Venezuela; Clyde Lee, football coach, University of Houston; A. R. Gouteyron, Shell Venezuelan Oil Concessions, Maracaibo; and Cecil Grigg, assistant football coach, Rice Institute, Houston.

JOHN MERRIAM, president of Northern Natural Gas Company, has been elected to the board of directors of the Calgary and Edmonton Corporation, Ltd. of Winnipeg, Canada. He will be the only U. S. citizen on the board. Other members are from Canada and England.

•

JOHNNIE WEDDLE, Eastman Oil Well Survey Company field engineer, recently returned from Papua, New Guinea, where he assisted the Australasian Petroleum Company, Ltd., on a sidetracking job. During his 30-day absence from the U. S., Weddle visited Honolulu, Fiji Islands, Sydney, and Port Moresby, Papua.

•

W. CAREY SUMMY, assistant division superintendent, Gulf Coast Division, Sinclair Oil and Gas Company, left Houston September 9 for Ethopia, where he will temporarily assist with Sinclair Petroleum Company of Ethopia's exploration of concessions.

W. Carey Summy

J. A. McQUILKIN, who was recently elected a director of Standard-Vacuum Oil Company, has been associated with the company's activities in the Far East for almost all of his 26 years in the oil business. Entering the industry in 1926, McQuilkin was assigned a year later as a salesman in Malaya. Subsequently he served as manager of sales districts at Ipoh, Penang, Kuala Lumpur and Singapore. He was made territory manager for Thailand in 1936 and in 1940 he was promoted to sales manager for the Malaya-Thailand division with headquarters at Singapore. Caught in Manila at the outbreak of Japanese hostilities in World War II, McQuilkin was interned at the notorious Santo Tomas prison for more than three years, and went back to Singapore in 1945 as postwar general manager of Stanvac's Malaya-Thailand division. He has been serving in the company's New York office since 1950 as deputy manager and subsequently as manager of the Southeast Asia marketing organization.

J. A. McQuilkin

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German Survey Shows 47 Wells Found Oil

German Geological Survey figures show that 47 deep wells found oil during April and May. In April 26 wells were successful. Among the May discoveries were the wildcat Boostedt 1 and extension wells Suderbrunch M 41, Hemmelte-West 5 and 6, Hohenwoehrden 4, and Scheerhorn 36.

Deutsche Erdoel-AG's Hohenwoehrden 4 was placed on production after the installation of a pump between 5789 feet and 5802 feet showed recovery of from 106 to 141 barrels of gaseous light oil daily. Situated 2000 feet south of Hohenwoehrden 3 in Germany's new field, well 4 struck two oil-bearing horizons in the Dogger, but a production test from the lower pay yielded non-commercial quantities of heavy oil.

Hohenwoehrden 5 subsequently struck oil in the Wesendorf horizon of the Dogger beta, between wells 3 and 4, which are producing from Limnic Dogger. This strike proves that another Dogger horizon in Schleswig-Holstein is oil bearing. Of particular interest was the fact that below the Neocome transgression almost the complete Liassic in overthrust position was penetrated. Below it followed the Dogger with the Dogger beta sandstone, also in overthrust position. Hohenwoehrden 5 is currently yielding betwen 263 and 282 barrels daily.

During April, footage drilled amounted to 97,999 feet, 38,196 feet less than in the following month. From January to May, 1952, a total of 619,096 feet was drilled in deep wells, of which 383,268 feet was drilled in production wells situated in known oil fields.

In addition, 13,917 feet was accounted for by shallow wells. The drilling program for 1952 provides for a total deep drilling footage of 1,606,023 feet, of which wildcats were scheduled to account for 671,894 feet and extension wells, 161,248 feet.

Two Montenegro Strikes

Two oil deposits have been discovered in Buljarica, Montenegro, at depths of 1650 feet and 1715 feet. Mobile drilling equipment will be sent from Lendava, according to Yugoslavian Marshal Tito's newspaper Borba. Other units for test drilling have already arrived at Brcevo, in the Smyrnia province, where work began in June.

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PRECISE AERIAL MOSAICS
AIRBORNE MAGNETOMETER SURVEYS
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Production Rate in Pakistan Indicates Increase for 1952

Production of oil for the second quarter of 1952 from the Attock Oil Company's concession in Pakistan was 249,803 barrels, an output which indicates that the total 1951 production of 672,740 barrels may be exceeded this year. In turn, crude production for 1951 showed an overall increase of 12,971 barrels from 1950, so that there is a small increase in productivity from the Attock fields in the Rawalpindi area despite difficult production conditions.

The Attock oilfields are at Khaur, Balkassar, Joya Mair, and Dhulian in the Punjab. The Khaur oilfield dates from 1915, and has given a considerable quantity of oil from Miocene Murree sandstones at depths down to 5000 feet. There has also been deeper production from an Eocene limestone, but in recent years production from Khaur has tended to decline and now continues at a low figure only.

A deep well recently drilled in this anticline got into mechanical difficulties and, in view of the more important work to be carried out at Dhulian, it has been temporarily shut down.

The Balkassar field was discovered after the war and yields a good quality oil at depths of around 8200 feet from Eocene limestone. During 1951 a well situated in a northerly position on this field was brought into production and has enabled the company to distribute more evenly its production over a wider area of the lease in accordance with its production practice.

No further productive drilling was carried out in this field during the last year, but several shallow holes were drilled for structural information.

The anticline of Dhulian, about ten miles southwest of Khaur was discovered in 1935 and since that time has given oil from the basal beds of the Murree series and in Eocene limestones in depths of about 7700 feet.

As a result of geological information obtained from the drilling at Balkassar, it was decided to deepen a well at Dhulian below the normal production level, and this well struck oil at 8260 feet.

Unfortunately, the flow of oil was accompanied by considerable water, and it was necessary to deepen a second well some 750 feet away from the initial test, and cement casing above the new horizon before the discovery well could be successfully completed. These wells are too close to check the extent of the new oil-bearing zone. The third well, located about four-fifths of a mile from the original field is now being rigged for deepening. While it is not yet possible to assess the full significance of this discovery, the crude is of a superior quality and lighter than that found in the Punjab. It is flowing under back pressure at over 600 barrels per day.

Drilling of the first well at Bains commenced towards the end of the year and the well was carried to 3599 feet, where it is in mechanical difficulties. A test at Dhariala is expected to start up soon, while structure testing is proceeding on a third area.

Crude Production Rise In Germany Is Continuing

Germany's crude production rise continued through June, when 1,029,492 barrels was produced—an increase from May of almost 14,000 barrels even with one day less production. Daily average production went up from 32,776 barrels in May to 34,317 barrels in June.

A setback in June was experienced in the old oil field Nienhagen, which yielded about 6300 barrels less than in May, whereas Hemmelte-West, Etzel, Heide, Eldingen, and Eddesse produced more than in May.

Discovery in Hohne Field To Bring Other Tests

Deutsche Erdoel-AG's Hohne 14 in Germany's Hohne field has found oil in the Dogger beta (Jurassic) at a depth of 4444-4460 feet. The production test yielded 353 barrels of crude with 10-15 percent water content. The well now is flowing 33 barrels daily.

Additional wells will be drilled to determine extent of the deposit which is probably a trap below the Alb transgression.

Joint Soviet-Roumanian Oil Industry Pact OKd

A new Joint Soviet-Roumanian enterprise for the oil industry was founded recently when delegates of the Ministers' Council of the Roumanian People's Republic and members of the Soviet Economic Mission in Bucharest signed the new pact.

The enterprise, named Sovrumutilaj petrolifer (sic) deals with the construction and manufacture of drill-

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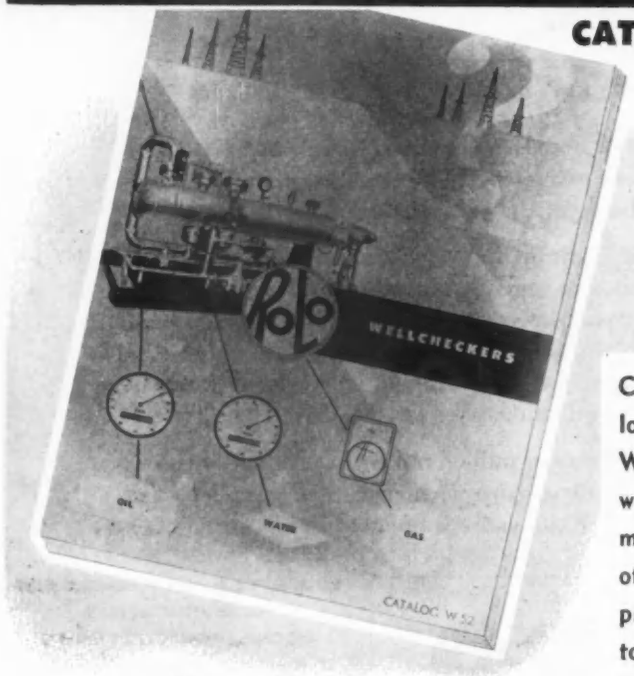

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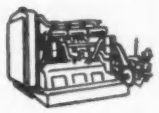

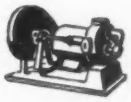

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ing and production equipment for the jointly-exploited oil fields, and with the manufacture and installation of refinery equipment.

Profits of the SovRum-UP (Utensils for Petroleum) are supposed to be split on a 50-50 basis between Soviets and Roumanians. Soviet engineers will take over—as in the 1948-founded SovRum Petrol (the enterprise dealing with oil exploration and exploitation)—the control of the corporation. Roumania offers the manufacturing facilities, raw materials and workers.

20.5 Million-Barrel Austrian Crude Production Indicated

Total Austrian crude production will exceed 20.5 million barrels in 1952, WORLD OIL has been informed through private Austrian sources. This volume is being produced by the Soviet-controlled and operated Lower Austrian oil fields, of which Matzen and Prottes are the largest.

More than 60 percent of the total output is being shipped to Eastern Germany, Czechoslovakia and other Soviet satellites. The remaining 40 percent is being purchased by the Austrian Government (the volume allocated by the Soviets) at Russian-set prices.

Oil production in Austria's East (Soviet-occupied) Zone is centered around three villages: the principal yield stems from the post-war discovered Matzen-Prottes field, where 51 oil wells are in operation; the 1934-discovered Zistersdorf field (called Gaiselberg and Goesting I and II) follows with an output of 12,000 barrels daily; Matzen, Adlerklaa, is the least productive of the three centers, averaging a daily yield of 4700 barrels.

German Gas Yield Rises To 1½ Billion Cubic Feet

During the first six months of this year, slightly more than 1½ billion cubic feet of natural gas was produced in the Federal Republic of Germany, 31.6 percent more than for the same period of 1951.

Approximately half of this yield came from the Bentheim gas field, the monthly production figure of which remained almost unchanged. At a yield of 177 Mmcf, the potentiality of the new Frenswegen gas field was not fully utilized during the six-month period. The supply of gas from Frenswegen to a textile mill at Nordhorn was temporarily suspended. During the first quarter, Frenswegen produced a monthly average of 45 Mmcf of gas. In April, the yield decreased to 22 Mmcf, and in June to 17 Mmcf. In May production ceased.

Preparations are under way to utilize Frenswegen gas for repressuring Georgsdorf oil field. Itterbeck field gas, production of which is scheduled to begin soon, is designed for the same purpose.

Among oil fields yielding natural gas as a by-product, Georgsdorf, Ruehlermoor and Wesendorf recently reported considerable increases in gas production.

Canadian Leases Let

Three Canadian companies have acquired interests in 9125 acres of oil and gas leases in the Beaver Lodge pool of the Williston Basin. They are New Concord Development Corporation and Consolidated Cordasun Oils Ltd., both of Toronto, and Jasper Oil Corporation of Montreal.

The Canadian companies are associated with M. B. Rudman of Dallas, Texas, and the Northern Development Company in the development of the acreage.

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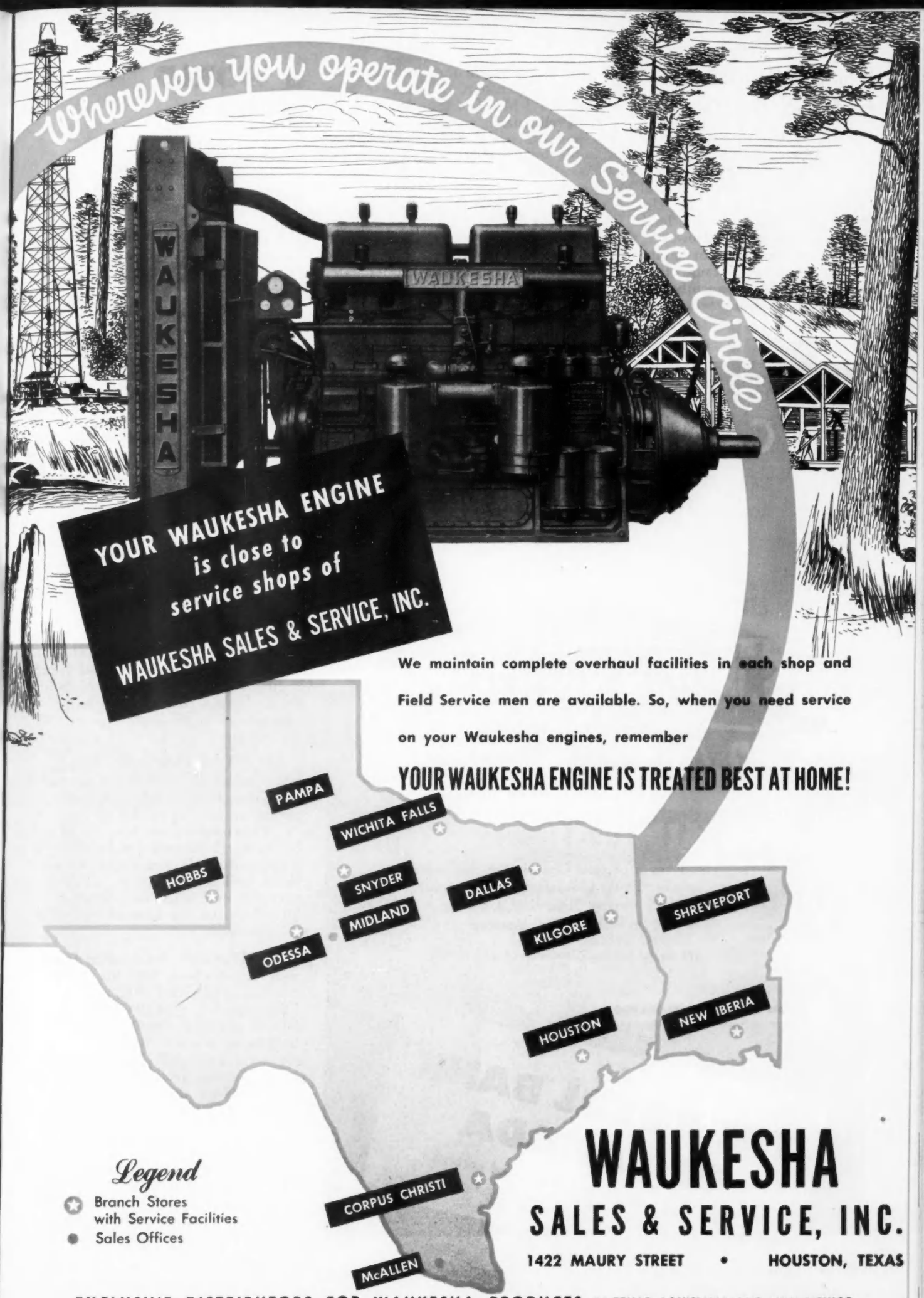
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Wintershall AG Rehden 5 Finds Rich Gas Deposit

Wintershall AG.'s Rehden 5, drilled in the area between the Weser and Ems rivers, near the village of Rehden, encountered a rich natural gas deposit at 7052 feet. At the close of 1951, gas traces had been found in Rehden 4 at 5792 feet. However, that shallow core hole was not suitable for regular production because of its narrow diameter. Consequently, Rehden 5 was drilled in the immediate vicinity and found gas in the main dolomite of the Zechstein. Production tests yielded 3 Mmcf of natural gas daily.

Preliminary analysis of the gas showed about 80 percent of combustible hydrocarbons. The remainder consisted of nitrogen and carbonic acid.

For the time being, the well has only opened the main dolomite of the Zechstein; the Platten dolomite, in which even better gas traces have been found, was reserved for later production tests. Wintershall AG has begun negotiating for use of the gas.

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By DON KLIEWER
WORLD OIL Staff

Following is the first of a series of columns which will appear in WORLD OIL's International Section in digest form to offer readers a quick roundup of oil industry items of interest from throughout the world. The column will serve to supplement the regular section news items.—The Editor.

ALBANIA: Government officials report the discovery of heavy oil resources in the Lake of Scutari zone . . . Drilled with former Italian-owned rigs, the two completed wells produced 33 barrels a day each.

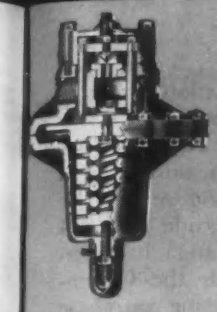
AUSTRIA: A total of $12,000 was allocated in August to pay for imported oil industry drilling equipment which will be used for test drilling in the Western (U. S.-occupied) Zone . . . The government has announced that gasoline rationing will end before winter.

TURKEY: The government will prepare for large-scale drilling for oil in the Diyarbakir region of Southeast Turkey. Preliminary tests have revealed sizeable deposits in the area . . . The Mineralogical Research Exploration Department has found what it believes to be evidence of large crude deposits in the Bismil and Silvan regions in the eastern section of the country.

AFGHANISTAN: A French company, Societe des Forages en Afghanistan, has been chosen from several applicants to prospect for oil reserves . . . The company was recently set up by Societe Nationale des Petroles du Languedoc Mediterranean, Pechelbronn and Societe Forex, and is expected to spud in its first wildcat about 50 miles from the Russian border in the northeast.

AUSTRALIA: Australia Associated Australian Oilfields recently drilled its initial test at Roma, Queensland . . . Just as soon as equipment is available, the Commonwealth Bureau of Mineral Resources will electric log the well . . . The Bureau is conducting geological surveys in the Carnavon area, where the Australian-American West Austrial Petroleum Pty. Ltd. is conducting reflection seismic surveys.

ITALY: Promising results have been achieved from wildcats at Ponte al Bozzone, four miles from Siena, where oil reportedly was found at 8450 feet . . . Previously, a methane



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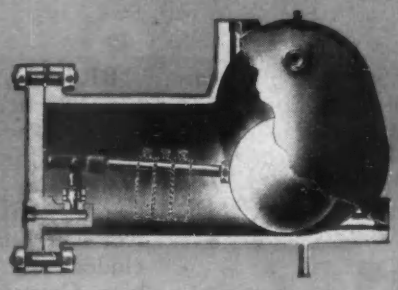

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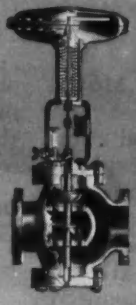

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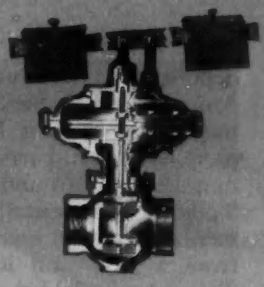

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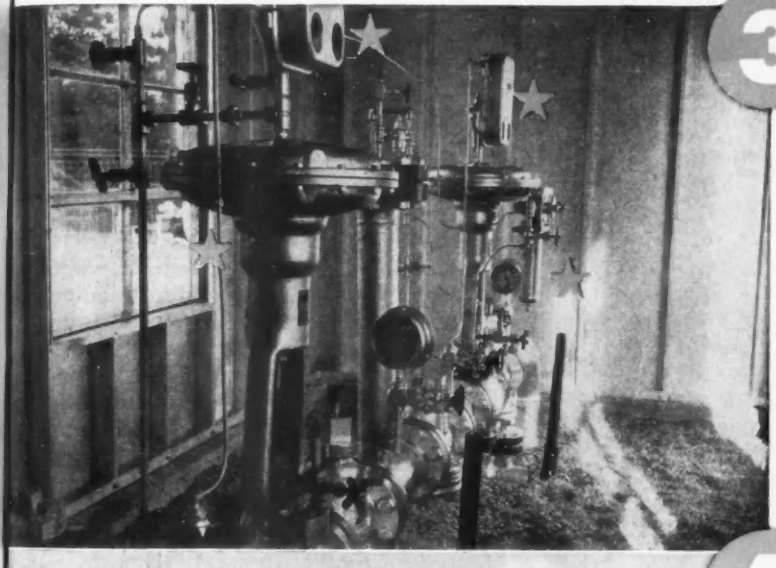

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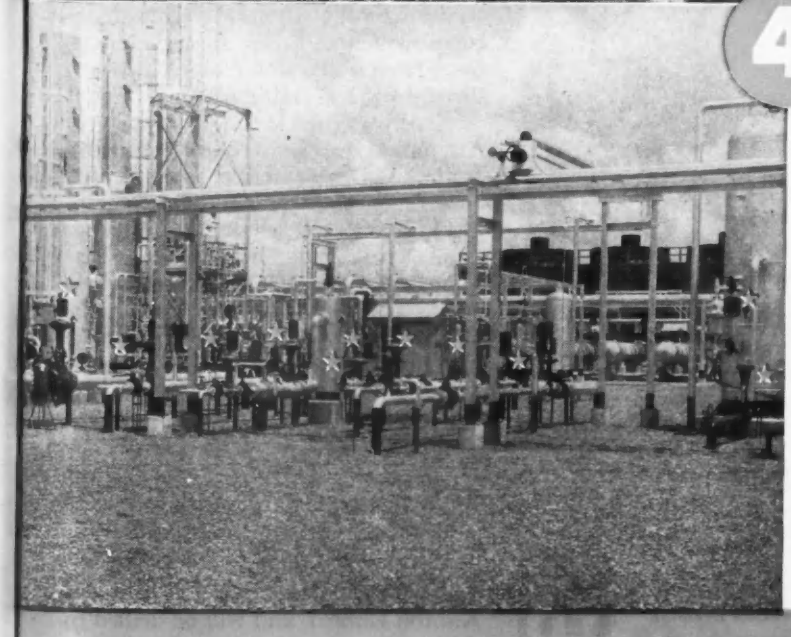

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deposit was discovered at Mount Amiata, also in Siena province, and technicians from a French oil company have been carrying out exploration drilling around Corleone, in Sicily . . . Incidentally, initial experimental efforts at methane production from a new well in the Valle di Tenna have yielded an unannounced but apparently large daily output of gas even though the well has not yet been put into regular production.

TRINIDAD: Dominion Oil, Ltd. has begun a broad exploratory venture . . . To date, this company has acquired leases or made applications on about 700,000 acres situated on the island and adjacent sea bottom.

SARAWAK: A new oil lease reportedly has been signed between the Government and Sarawak Oilfields Limited.

PERU: At least four domestic companies have requested exploration concessions in the Sechura Desert area . . . This indication of rising interest in petroleum resources followed publication of the regulations governing the country's new oil law administration.

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BRAZIL: The National Petroleum Council has announced discovery of a new oil zone at Pojuca, about 40 miles north of Bahia, now Brazil's chief crude and refining area. One test well has found crude at 4264 feet . . . Empresa Ipiranga has concluded a contract with the Colombian Government covering purchase of 600,000 barrels of oil.

IRAQ: Iraq Petroleum Company's Kirkuk field yielded a recorded output in August, with more than 11½ million barrels . . . This record is equal to an annual rate of more than 142 million barrels and approaches the target set for Kirkuk of almost 165 million barrels . . . Two IPC associates have announced final figures on their first six months production—Basrah Petroleum Company produced 6,823,000 barrels from the Zubair field in Southern Iraq and Petroleum Development (Qatar) Ltd. produced 11,695,000 barrels from its field in the Persian Gulf.

GERMANY: Emsland-Erdoelleitung GmbH is laying a pipe line from Osterwald to the refinery and harbor of Holthausen, near Lingen. The 5-inch, 13½-mile, aboveground line will be able to handle from 21 million to 28 million barrels of oil annually. Completion of the line and installation of pumping installations at Osterwald are expected by year's end . . . A new commercial treaty has been concluded between the Federal Republic and Iran which is retroactive to June 1, 1952, and will run until March 31, 1953. The treaty, however, provides for no oil imports from Iran . . . Reportedly, the long-awaited $2 million additional allocation of Mutual Security Agency funds for crude imports from dollar concessions has been sliced by $1.24 million—the amount originally earmarked for imports of Arabian American Oil Company crude. MSA blamed this restriction on Aramco's prices . . . The remaining $760,000 will be used to buy Venezuela crude . . . The draft of a new import duty schedule on crude which would place German and foreign oil companies in Germany on equal footing customs-wise is nearing completion.

SWITZERLAND: Itag Internationale Tiefbohr AG, Hermann von Rautenkranz, Celle, Germany, has installed equipment to spud in the first post-war deep oil test in Switzerland. The well will be situated in Nebikon/Kanton Luzern, and will be drilled by order of a Swiss joint interest group headed by Iborag, Zurich.

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News of Men in the Industry

Stanton K. Smith, president of Smith Oil & Refining Company at Rockford, Ill., was elected 1953 chairman of the national Oil Industry Information Committee in September to succeed **Charles Z. Hardwick,** vice president of The Ohio Oil Company. Smith, associated with the OIIC since its inception, was the first state chairman in Illinois, and has been a member of the national committee since 1947. A graduate of Dartmouth College and of the Amos Tuck School of Business Administration and Finance, he is also president of the Smith Oil Transportation Company and serves four other organizations in executive capacities.

Stanton Smith

•

J. K. Jamieson, formerly assistant general manager of the manufacturing department, has been elected a director of Imperial Oil also. A graduate of the University of Alberta and the Massachusetts Institute of Technology, he joined Imperial Oil shortly after the war as a member of the coordination and economics department.

•

W. C. Stevenson has been elected vice president Industrial Relations of Union Oil Company. Stevenson joined Union Oil in 1925 as a utilities inspector at the Oleum refinery. A mechanical engineering graduate of Stanford University, he served in a number of supervisory assignments before being appointed manager of the Los Angeles refinery in 1942. He has headed the Industrial Relations department under executive vice president W. L. Stewart, Jr., since 1946.

•

Frank W. Jessen, consulting engineer, Austin, has accepted the position of Visiting Professor in Petroleum Engineering at the University of Texas for the 1952-53 year.

•

G. E. Wegner has been elected vice president of the Willingdon Drilling and Exploration Company and will take charge of operations in the Williston Basin area.

•

Richard T. Lyons of Houston, has been elected president, chief executive officer and a director of Union Sulphur and Oil Corporation effective November 1. **Herman F. Whiton,** chairman of the board, will relinquish the presidency at that time, but continue active in the affairs of the company.

Lyons has been vice president in charge of exploration in the Midcontinent Division of Tide Water Associated Oil Company for the past 16 years. Previously he was vice president and director of Skelly Oil Company. He will make his headquarters in Houston.

Sir Robert Watson-Watt, renowned British scientist whose pioneer development of radar is credited with having been essential to winning the "Battle of Britain," has assumed office as president of the New Continental Oil Company of Canada, Ltd.

Sir Robert was elected as president and as a director at a meeting of the board October 10, succeeding Frank Kaftel, former president and managing director, resigned.

New Continental, with large producing properties in Western Canada and Texas, recently has begun research into the use of electronics for oil exploration in an effort to reduce the cost and waste of "dry hole" drilling, and Sir Robert has been advising the company on these matters.

Sir Robert said he hoped it might prove feasible with new, sensitive electronic devices to "sound" scientifically for oil with less speculative drilling than now. He said, however, it had not yet been determined that radio waves could be applied to probing into the earth's crust.

•

George W. Jandacek has joined the Research and Development department staff of Deep Rock Oil Corporation. Jandacek will serve as a chemical engineer and will be stationed at Cushing, Okla. A graduate of Northwestern University, he was employed by a petroleum engineering company in Chicago before joining Deep Rock.

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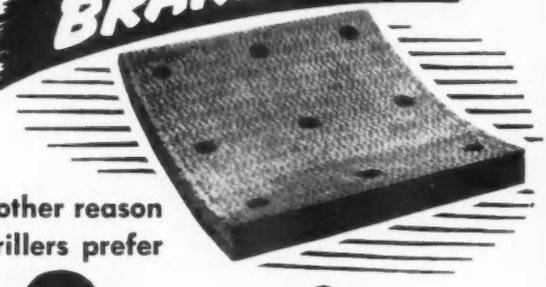

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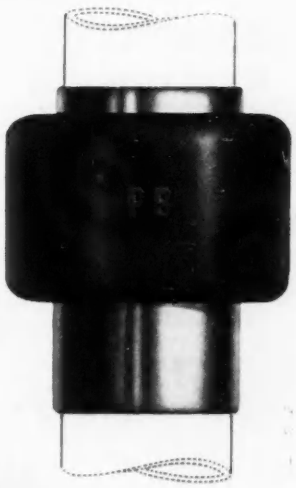

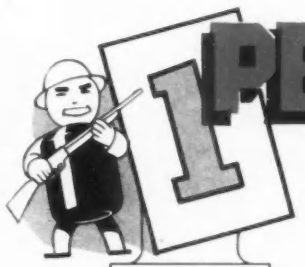

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Carl E. Kleiber

Dr. Frank T. Barr

Carl E. Kleiber and **Dr. Frank T. Barr** have been granted the title of senior engineering associate by Standard Oil Development Company. SOD developed this program of recognition in 1946. **Maury Lapeyrouse** was granted title of senior research associate. Lapeyrouse, Westfield, N. J., joined the organization in 1932 from Standard Oil Company of Louisiana. Dr. Barr, Summit, N. J., has been in his present assignment since 1936, also transferring from Standard-Louisiana. Kleiber, Esso Engineering department, lives at Irvington, N. J. He joined Standard-New Jersey in 1926.

•

Harold L. Geis, formerly division geologist for Barnsdall Oil Company and more recenuy associated with the consulting firm of The R. B. Mitchell Company, has opened offices in the Esperson Building, Houston, as a geological consultant. Geis has been active in Gulf Coast geology since 1935 when he was first employed by Shell Oil Company. Geis is a geology graduate of the University of Illinois, and was a research fellow in the graduate school at Chicago University.

Harold Geis

•

P. W. Thirtle, vice president of Sinclair Oil Corporation, has been elected a director of Richfield Oil Corporation. Thirtle has been actively associated with Sinclair Oil and its predecessor companies since 1916.

•

S. R. Lenning has been appointed district superintendent of the Panhandle district of West Texas for The Texas Company's Producing department. He succeeds **D. J. Gribbon** retired. Lenning has been assistant district superintendent since 1948, having moved up from gang pusher, his first job with the company. Lenning makes his home in Pampa, Texas.

•

Wilbert M. Neilsen, a senior at Oklahoma University and a native of Calgary, Canada, has been awarded the newly established $750 Socony-Vacuum Canadian scholarship in petroleum engineering at O. U. Nielsen will receive his degree in petroleum engineering June, 1953.

•

William P. Adent, geologist for the past three years with Bankline Oil Company, the last two of which were spent in the Midland, Texas, area, has joined the staff of Wm. Ross Cabeen & Associates, consultants. He will be engaged in exploration work in the Midland office of the Cabeen organization.

J. W. Hamilton, Q. C., has been elected a director of Imperial Oil Limited. Hamilton has been associated with the company's law department since 1938. He is a graduate of the Royal Military College at Kingston, Ontario, and Osgoode Hall.

•

Frank McMahon, former president of Pacific Petroleums, Ltd., Canada, has been elected chairman of the board and **George L. McMahon** succeeds him as president. **C. H. Wright**, chairman of the board, Sunray Oil Corporation, has been appointed a director. **N. R. Whitall**, retiring chairman of the board, retains his directorship.

•

Claude R. Hocott, assistant head of Production Research, Humble Oil & Refining Company, Houston, was elected 1953 chairman of the Petroleum Branch, AIME, at the fall meeting, October 2-3, at Houston. He received his BS degree in chemical engineering from the University of Texas in 1933, his masters degree in 1934 and his Ph.D in 1937. He is a member of Tau Beta Pi, Phi Lambda Upsilon, and Sigma Xi. Immediately after his graduation, Dr. Hocott joined Humble as a research engineer, and became assistant head of Production Research in 1942. Other officers elected for 1953 include **Basil P. Kantzer**, Union Oil Company of California, Los Angeles, vice chairman, and **John P. Hammond**, Amerado Petroleum Corporation, Tulsa, also a vice chairman. Two new members to the executive committee are **Roland Bouldy**, Hull-Silk Repressuring Association, Wichita Falls, Texas, and **Thomas A. Atkinson**, General Petroleum Corporation, Casper, Wyo.

Claude Hocott

•

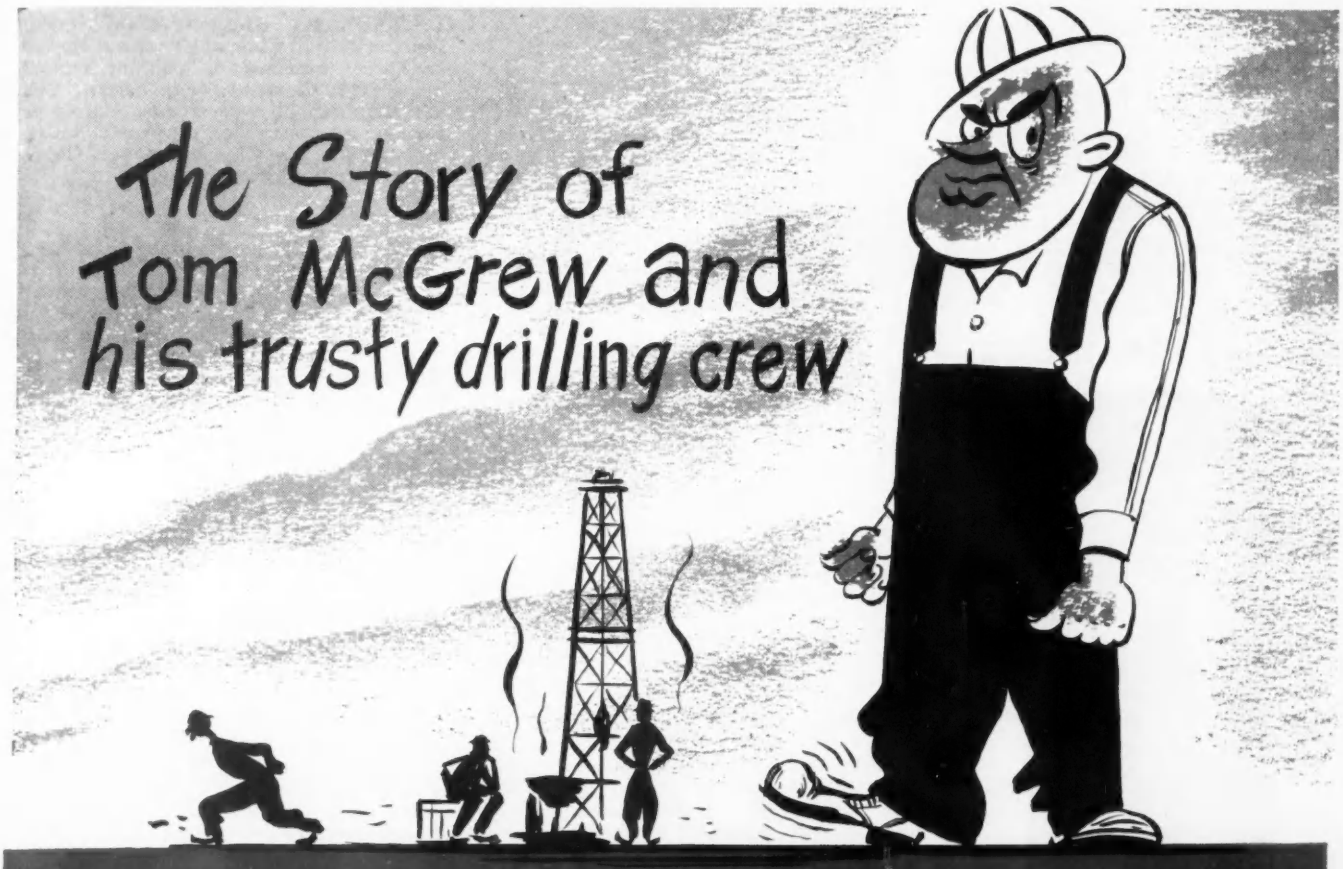
George M. Washington, landman, has been appointed general manager, Oil Development Department, of Northern Pacific Railroad Company. He was formerly associated with G. W. Anderson and J. R. Williams, lease brokers of Salt Lake City, and Standard Oil Company of California in the land department.

•

Gardner P. Wilson has joined Consolidated Engineering Corporation as a senior development engineer and will be in charge of the mass spectrometer group of the Engineering department. From 1945 to 1952 Wilson headed the Test division of the U. S. Naval Ordnance Test Station at Pasadena, Calif. He resides in Altadena, Calif.

•

P. C. Livesay, assistant general superintendent of Standard Oil Company's Whiting, Ind., refinery, recently became manager of the projects, capital expenditures, and miscellaneous contacts division in the company's general office manufacturing department at Chicago. Livesay joined Standard in 1937 as an engineer at Whiting. In 1943 he became foreman and in 1946 general foreman of the heavy oils division. He was appointed superintendent of the projects division in 1948 and assistant general superintendent of the refinery in 1950.



This is the story of Tom McGrew—
a tool pusher and his trusty crew.
They were going great guns on McFudd No. 1
when the rig broke down and spoiled all the fun.
They worked and they sweat and they cursed the day
that had brought them this trouble and caused delay.
On into the night—It was really a chore
patching old parts to get started once more,
But each new effort ended in despair
and Tom finally admitted, "It's beyond repair."
It would look pretty bad on the drilling report
for a crew with such talent to be caught so short.

The gloom of the night showed up in each eye,
Until George True, star driller, yelled United Supply!
"You're right, said Tom, his face shining bright
they'll get us the parts and relieve our plight.
Soon a truck was speeding to McFudd No. 1
With everything needed to get the job done.
So the moral of our story is plain to see
that from United you get Service and Dependability.
And whenever you're needing supplies in a hurry
just call United and then don't worry.
You'll get them real quick, and that is why
You can always rely on United Supply!

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J. B. Ladd has been named district petroleum engineer at Craig, Colo., by the Producing department of The Texas Company. Ladd is a petroleum engineering graduate of the University of Kansas and has served The Texas Company in northern Montana and more recently in Wyoming.

•

Leslie C. Spencer, geophysical consultant, Shreveport, La., has become a full partner in the Mountain Geophysical Company with **Jesse E. Spencer**, at Denver.

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Dr. McNatt

H. W. Brown

H. W. Brown, Tulsa, Okla., has been appointed chief geophysicist of The Carter Oil Company, succeeding **R. W. Gemmer**, now manager of Carter's Northern Exploration division. Brown joined Carter in 1935 and served in Jackson, Miss., and Shreveport, La., in the geophysical department until 1945 when he transferred to Tulsa as supervisor of foreign operations in the company's exploration department. He served as assistant chief geophysicist since August, 1949. **Dr. Eugene M. McNatt**, an assistant chief of research at the Tulsa laboratory of The Carter Oil Company has been named assistant to H. W. Brown chief geophysicist. Dr. McNatt joined Carter in 1939 after completing work at Washington University, St. Louis, and the University of Colorado at Boulder. Carter Oil has named **Sam R. Marsh**, Denver, geophysical supervisor of the newly formed Northern Division. Marsh is a graduate of the University of Oklahoma, Norman, and of Baylor University, Waco, Texas. **F. G. (Geoff) Boucher** has been named assistant chief of research at the Carter Oil laboratory in Tulsa. Boucher, a veteran of 23 years with Carter and Jersey Standard affiliates, has been head of the development engineering section. He began his career with Humble Oil & Refining Company at Houston in 1929 as a research geophysicist. **John Eckel** has been named head of the new drilling methods section of the development engineering section, while **C. B. Scott** will take charge of the new geophysical engineering section. Eckel is a petroleum engineering graduate of the University of Oklahoma. Scott, an Oklahoma A. and M. College graduate in electrical engineering, has been with Carter since 1935.

•

Joe A. Laird, geologist and petroleum engineer, and for the past three years professor of petroleum engineering at Texas A. & M. College, has opened consulting offices in Houston. For several years Laird served as geologist and petroleum engineer for George W. Strake, Houston independent oil operator and was also district engineer for the Texas Railroad Commission in Houston. He received his degree in petroleum engineering from Texas A. & M. and a master's degree in geology at the University of Oklahoma. He is a registered engineer, a member of the American Association of Petroleum Geologists and American Institute of Mining & Metallurgical Engineers.

•

Walter B. Dingle, formerly assistant division engineer, has been promoted to Western division engineer of Imperial Oil Limited, with headquarters at Calgary, Alberta. **J. W. Young**, formerly research engineer, Western division, was advanced to the position of assistant division engineer.

G. T. Pearson, manager of production, Continental Oil Company's central region, has been promoted to assistant general manager of the region with headquarters at Oklahoma City, succeeding **Harold S. Skinner**, transferred to Fort Worth, Texas, as assistant general manager of Continental's southwestern region.

•

Dr. R. W. Millar has been appointed head of the chemical engineering department at Shell Development Company, leaving **Dr. Mott Souders, Jr.**, free to devote his attention to his principal duties as associate director of development. **Dr. C. L. Dunn** succeeds Millar as head of the physical chemistry department, and **Dr. R. L. Maycock**, formerly development supervisor, replaces Dunn as assistant department head.

•

Richard W. Rush, has been appointed assistant professor of Geology at the University of Texas. He is a graduate of Iowa University, and received his M.S. degree at Columbia University. He recently was employed by the Plateau Exploration Company at Cortez, Colo., and has published papers on the Silurian strata of Southwestern Utah.

•

David T. Kiester has been promoted from petroleum engineer to superintendent of production for F. Kirk Johnson & Brooks-Scanlon's West Texas operations. Kiester was formerly with Ohio Oil Company but has been associated with F. Kirk Johnson as petroleum enginer for the past year. Kiester was transferred from Fort Worth to Abilene, Texas where F. Kirk Johnson & Brooks-Scanlon will maintain a production office.

•

E. H. Blackaller has been named district engineer in Stanolind Oil and Gas Company's Lubbock district, North Texas-New Mexico division. Blackaller, a native of Pearsall, Texas, joined Stanolind in 1943, immediately after graduating from Texas A. & M. College in Petroleum Engineering. He was promoted to petroleum engineer in 1945, and served in both the division office here and the Panhandle area office, in Pampa, until 1948 when he was transferred to Tulsa. In January, Blackaller was named executive assistant to Frank Lindeman, Jr., Manager of Stanolind's production department, a position he held until his recent promotion.

E. H. Blackaller

•

W. B. Hayes, formerly drilling superindent of International Petroleum Company in Peru and Colombia, has accepted a like position with Dunlap & Graham Drilling Company, Inc., and is now in charge of the Company's drilling operations in Colombia. Dunlap & Graham spudded in its first well for Interco in the Barranquilla area in Colombia in September, 1952, and as of today is drilling ahead at 5000 feet.

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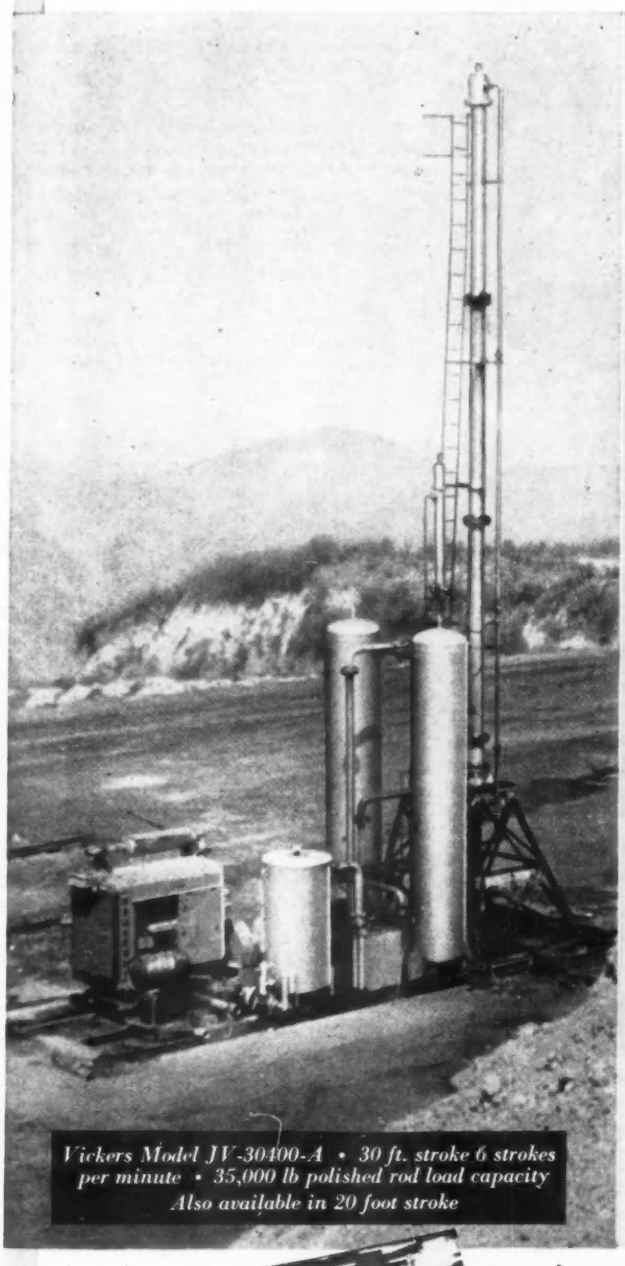

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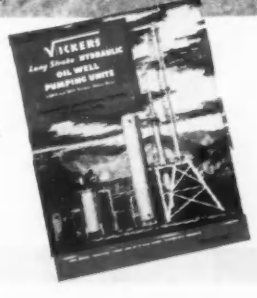

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Dr. H. H. Kaveler, Bartlesville, Okla., has resigned as assistant manager of the production department, Phillips Petroleum Company, to engage in business for himself in Tulsa. Dr. Kaveler is one of the outstanding exponents of conservation through unitization in the oil industry. **L. E. Fitzjarrald** will continue as manager of production and **John Houchin** as general superintendent of the production department. **Jack Tarner**, now chief reservoir engineer, has been named technical advisor to the manager of production and will be in charge of reservoir studies, unitization and proration.

•

F. B. Jordan Jr., has been elected an assistant secretary of The Carter Oil Company, replacing **H. E. Rogers**, retired after 37 years of service.

W. M. Jones has been named field superintendent in Stanolind Oil and Gas Company's Henderson area of the North Texas-New Mexico division. The area's office is in Henderson. Jones replaces **R. G. Peeler**, who was transferred to North Cowden. Prior to his new assignment, Jones was district engineer at Lubbock. He first joined Stanolind in 1940 as a roustabout in the Panhandle area.

•

Dr. Robert L. Folk has joined the University of Texas staff as assistant professor of Geology. Dr. Folk received his degrees from Pennsylvania State College, and before his appointment at the University was a specialist in Sedimentation for Gulf Oil Corporation at Houston. He has published papers on the porosity of limestone and electron microscope study of charts.

Dee Davis, secretary and treasurer of The California Company, New Orleans, and **Laurence D. Luey**, assistant treasurer of the Southern Natural Gas Company, Birmingham, were elected regional vice presidents of the Controllers Institute at that organization's 21st Annual meeting, held October 5-8 in the Sheraton-Cadillac and Statler hotels, Detroit. At the same meeting, **Wilson K. Minor**, assistant comptroller of the Standard Oil Company of California, San Francisco, was chosen a director.

L. D. Luey

•

Fred S. Reynolds, formerly reservoir engineer for Humble Oil & Refining Company at Houston, has joined Cummins & Brinkerhoff, oil and gas consultants at Fort Worth, Texas.

•

Donald M. West has been transferred from the New York office of Socony-Vacuum Oil Company, Inc. to the Regina, Saskatchewan, office of Socony-Vacuum Exploration Company, where his position is that of district geologist.

•

M. Mallyveen Miller, formerly of Shell Oil Company, Inc., Midland, Texas, has joined Bernard F. Dudley, New York City, broker of oil properties.

•

Tennant J. Brooks has been appointed geologist for the Franco Western Oil Company. Brooks joined Western from Standard Oil Company of California where he had been employed as a geologist for the past five years. Prior to his employment by Standard he was associated with Ferguson and Bosworth in Bakersfield. His undergraduate training was received at the University of California at Los Angeles from which he graduated in 1941 with an A.B. degree in Geology. Immediately following graduation he joined the U. S. Navy and for the duration of the war served as a Radar and Photo Interpretation Officer.

•

James F. Neill has been promoted to assistant division manager, Rocky Mountain division of The Texas Company's Producing department. Neill, a native of Denver, is moving up from general superintendent of drilling and production, West Texas division, and in this new assignment will move from Fort Worth to Denver. He is a graduate of the Colorado School of Mines, with a B. S. degree in petroleum engineering. He entered the service of The Texas Company in August, 1935, at McCamey, Texas.

•

R. W. Stoneburner has been named district exploration superintendent of the Southeast Louisiana district for The California Company.

Stoneburner, with The California Company since 1948, has had experience in geophysical operations and stratigraphic and subsurface geology in South Louisiana. He received his B.S. degree from Wooster College and a Masters degree in geology from the University of Kansas.

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REVOLUTIONARY DEVELOPMENT. This new retrievable gas lift equipment permits installation or removal of valves without the bother or expense of pulling tubing. Lowered on a wire line, the valves latch securely into position in the long "side pockets" of the specially-designed mandrels, leave a clear, unobstructed path up and down the entire tubing string for remedial work and swabbing. With valve parts made of corrosion-resisting Monel, operators are assured of dependable protection against severe sub-surface conditions. *Photos and operating data courtesy of Camco, Inc.*

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How is it done? With retrievable valves in specially-designed mandrels. This long-needed combination has recently been developed by CAMCO, INC., of Houston, Texas.

Install the new mandrels in your tubing string, and the biggest part of the job is over. From this point on, you selectively place or remove the retrievable valves whenever you want. The location of the mandrel in the string doesn't make any difference. Nor the depth. You don't disturb other valves. And you don't have to pull a single joint of tubing.

Think what this can mean in terms of savings in time and labor, particularly for deep wells or offshore installations!

Meeting Severe Conditions

Another big feature of the *Camco* retrievable valve is its availability in Monel®. Like many manufacturers of oil field equipment, *Camco* uses Monel because it combines high strength and toughness with an exceptional degree of resistance to corrosion, abrasion and wear.

With Monel, your equipment is protected against severe stresses and shocks. Against the cutting action of gas under pressure. Against the destructive attacks of hydrogen sulfide, brine and entrained solids... even at high well temperatures.

As has been demonstrated time and again, you can always count on the dependability of "Monel-protected" equipment – even in the worst sour gas areas of the mid-continent district. In some West Texas and New Mexico wells, for example – where the life of steel valves is usually measured in *days* or *weeks* – Monel valves have often given *years* of service.

For complete information covering the additional features and advantages of *Camco* retrievable gas life equipment, write CAMCO, INC., 7315 Canal Street, Houston, Texas.

Remember, though, that Monel, like all Inco Nickel Alloys, is on extended delivery because so much is taken for defense. By ordering well in advance – and giving NPA rating and full end-use information – you'll improve your chances of getting delivery when you need it.

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DEATHS

Henry M. Dawes, 75, executive committee chairman of the Pure Oil Company since 1947, died September 29 in Evanston, Ill. Dawes was president of Pure Oil from 1924 to 1947 and at one time served as director of the American Petroleum Institute. He became associated with the petroleum industry in Marietta, Ohio, around 1900 when he became president of the Southern Petroleum Company.

•

Thomas Joseph McMahon, 39, field supervisor for Creole Petroleum Company, died October 1 at Las Piedras, Venezuela. A native Houstonian and son of the late T. J. McMahon, one time vice president of Texas Company's Pipe Line division, McMahon had been in Venezuela three years and was planning to return to Houston in December.

A. B. Allen of Wichita, Kans., died September 28 from injuries received in an automobile accident near Mineral Wells, Texas. He was superintendent for the J. J. Lynn Oil Company of Wichita.

•

Richard E. Eckels, 58, secretary-treasurer of the Zenith Petroleum Company, Oklahoma City, died September 22. He was widely known for his Boy Scout work.

•

Matt Steil, 80, prominent Oklahoma oil operator, died September 8 at a Tulsa, Oklahoma, hospital.

Henry F. Forbes, 35, regional petroleum engineer in the Southwest for Continental Oil Company, died September 20 at Fort Worth. Forbes, a friend of executive and roustabout alike, was widely known for his warm personality and his friendly smile. Because Forbes coupled an unusual capacity for human understanding with engineering skill, the oil fraternity has lost a great friend.

Henry Forbes

He joined Continental as a roustabout, following his graduation from Colorado School of Mines in 1938, to work in the Big Muddy field in Wyoming. In 1939 he was transferred to West Texas where he served until 1942 when he joined the armed forces as an aviation engineer. Rejoining Continental at Hobbs, N. M., in 1943 he was subsequently promoted to district petroleum engineer of the West Texas district, and then New Mexico division petroleum engineer of the West Texas district in 1947. He had served as regional petroleum engineer since 1949. Forbes belonged to the API, AIME, Texas-Mid-Continent Oil and Gas Association, the Fort Worth Petroleum Engineers' Club, the IPAA and the Masons.

•

Donald H. Lycan, 63, vice president and director of the Signal Oil and Gas Company, died in Rome, October 14.

Born in Edina, Mo., he received his A.B. from Missouri State University in 1910. Two years later, he moved to California and was associated with the California Bank until 1920 when he became interested in the Huntington Gasoline Company.

When Signal took over the Huntington Gasoline Company, Lycan became a stockholder in the original Signal Gasoline Company. In 1930, he became an active member of the Signal Oil and Gas Company organization and for many years has been a director and vice president in charge of the Land and Geological department of the company.

•

George H. Lang, 58, of Tulsa, Okla., died September 1 while attending the annual meeting of the AAODC at Oklahoma City. Lang was president and owner of the Beacon Drilling Company and a one-time vice president and director of The Carter Oil Company.

•

John H. Weller, 57, died September 27 in Newburgh, N. Y. Weller had been with the transportation division of the Standard Oil Company for many years.

•

David Bartlett, 33, died September 22 in Houston. Bartlett was report and patent coordinator for Humble Oil & Refining Company.

•

Don Franz Tilden, 74, retired Oklahoma oil operator, died September 6 at Claremore, Okla.

•

Frank L. Alban, 62, vice president in charge of operations for the First National Bank, Tulsa, died September 7 at his home in Tulsa. He was well known to the oil fraternity in the Mid-Continent area.

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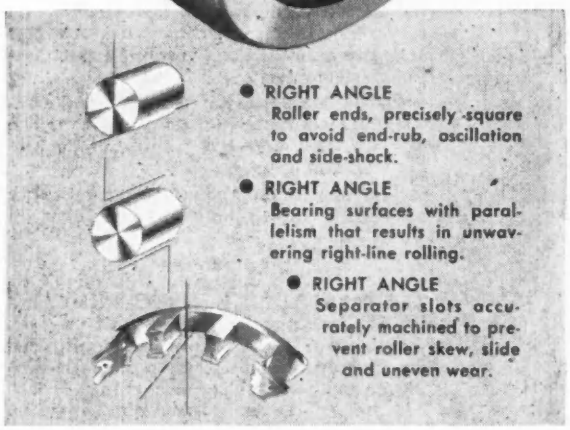
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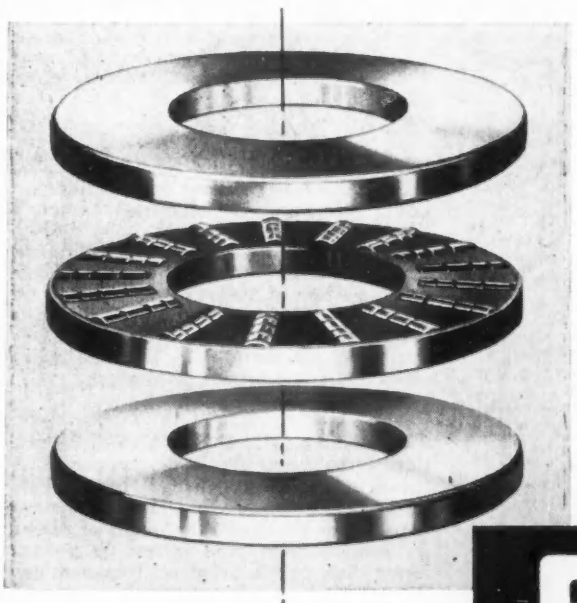

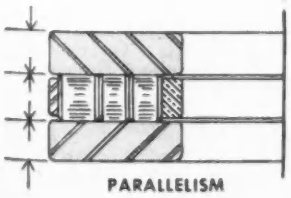

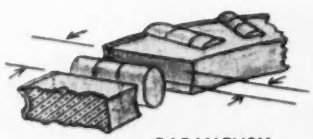

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Companies in the News

THE CALIFORNIA COMPANY, to facilitate concentration of effort and accomplishment of the shifting exploration work program in the Southeastern division, is establishing a new Exploration district, South Alabama-Georgia-Florida district. The geographic area of the present district headquartered at Jackson, Miss., will be reduced accordingly and renamed the Mississippi-North Alabama district.

R. D. White, division exploration superintendent, has made the following appointments in connection with this change: South Alabama-Georgia-Florida district (headquarters at Pensacola, Florida), J. E. McCall named district exploration superintendent; L. E. Scott named district landman.

North Louisiana-South Arkansas district (headquarters at Shreveport, La.), L. C. Powell named acting district exploration superintendent.

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O-C-T Needle Valve bodies are single piece drop forged steel. The male thread is made as an integral part of the valve which gives you a more compact, stronger connection. This one-piece O-C-T Needle Valve design eliminates the use of nipples and minimizes the chances for leakage. Buy O-C-T Needle Valves from your supply store. There is a difference . . . and O-C-T makes the difference!

Oil Center Tool Co. P. O. Box 3091 Houston, Texas

Export Representatives: Sterling Areas—Le Grand, Sutcliff & Gell, Ltd., Rochester, Kent, England. Address Export Inquiries for All Other Countries to P. O. Box 3091, Houston 1, Texas.

TIDE WATER ASSOCIATED OIL COMPANY has acquired the trade-name "Federal," one of the oldest tire marks in the industry, from United States Rubber Company. Tide Water has been excusive distributor of the Federal tire and tube since 1947.

•

SUNRAY OIL CORPORATION has announced re-alignment of executive personnel in order to combine its midcontinent and California division properties operations. In the move **Paul E. Taliaferro** was named executive vice president, a new capacity in the company. Taliaferro has been serving as director and assistant to the president.

H. O. Harder, vice president and manager of the midcontinent production division, has been named vice president and manager of the exploration department, of all the areas. R. F. Foss, vice president of the California division at Los Angeles, will move to Tulsa to become vice president and manager of exploitation department for the company.

H. W. Manley, vice president and manager of manufacturing, sales and pipe line division, will add the California area to his responsibilities.

The new line-up consolidates executive management of operating divisions in Tulsa.

•

THOMAS P. PIKE DRILLING COMPANY, Los Angeles, recently observed its joint annual family picnic and Profit Sharing Day. Annual distribution of profit sharing checks were given Pike employes who had helped create extra profits by teamwork and intelligent application to their individual jobs. Operating under a plan of Incentive Management with Profit Sharing, a fund of $57,500 was apportioned among 138 employes. To date a total of $245,000 has been disbursed.

•

CONSOLIDATED ENGINEERING CORPORATION has opened new and larger offices for its subsidiary company, CEC Instruments, Inc., at 285 Madison Avenue, New York. The offices will handle sales and services for Consolidated Engineering's line of analytical instruments for science and industry, including the company's newly announced electronic computer and automatic data handling equipment.

•

THE OHIO OIL COMPANY'S Production department has been recognized by the National Safety Council for its 1951 safety performance. Ohio Oil's Production department received the Award of Honor for establishment of a record 69 percent lower than par in accident frequency and 91 percent lower in severity.

•

SOCONY-VACUUM OIL COMPANY'S 20-year clubs held their annual dinners between Oct. 17 and 31 in 16 cities throughout the country. Executives of the company attended the dinners. Similar affairs have already been held at Butler, Pa., and Olean, N. Y. Largest of the dinners was held in the Hotel St. George, Brooklyn, with 1300 in attendance.

Service

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Second National's Oil and Gas Division is staffed by petroleum engineers who are up-to-the-minute on oil and gas developments and understand the problems of the industry.

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Association News

John R. Suman J. S. Abercrombie

J. L. Latimer Harry Bass

Mid-Continent Group Honors J. S. Abercrombie and J. L. Latimer

J. S. Abercrombie of Houston and J. L. Latimer of Dallas, president of Magnolia Petroleum Company, received awards for distinguished service to the oil industry last month at the annual meeting of the Texas Mid-Continent Oil and Gas Association in Fort Worth.

John R. Suman, vice president of Standard Oil Company (N. J.), made the presentation to the Houston oil man, and Harry Bass of Dallas presented the award to Magnolia's president.

This association adopted resolutions (1) asking that the controls on petroleum be lifted in accordance with the law passed at the last session of Congress which provided for such action when any product becomes in plentiful supply; and (2) condemning charges made by the Federal Trade Commission with respect to the market demand provisions of the state conservation laws. The resolution held that the FTC report is "a reflection upon the Legislature of Texas and the administration of its conservation laws by the Railroad Commission of Texas."

R. F. Windfohr of Fort Worth, president of the association, was reelected, as were Charles E. Simons of Dallas, executive vice president; Andrew M. Howsley of Abilene, vice president and general counsel; Eugene McElvaney of Dallas, treasurer; and Corbin J. Robertson of Houston, vice president.

Speakers included Dr. Charles F. Kettering, vice president of General Motors Corporation, whose topic was "Fuel and Engine Relationships"; Lieut. Gen. Ernest O. Thompson of the Texas Railroad Commission; John R. Suman; Dr. Raymond Rodgers, professor of banking, New York University, who spoke on "Who Shall Control Our Money?"; Reese H. Taylor, president of Union Oil Company of California, whose subject was "Oil Shale"; and Hines H. Baker, president of Humble Oil & Refining Company, whose subject was "Statesmanship in Industry."

Invocation and address of welcome were given by Dr. M. E. Sadler, president of Texas Christian University.

IPAA Re-elects Lyons, Other Officers to Serve 1952-53

Members of the Independent Petroleum Association of America at their 23rd annual meeting in Oklahoma City re-elected Charlton H. Lyons, Shreveport, La., president. Other officers re-elected included: H. B. Fell, Ardmore, Okla., executive vice-president; Russell B. Brown, Washington, D. C., general counsel; C. E. Nuchner, Tulsa, executive manager, and D. R. Snow, Tulsa, treasurer.

The following vice-presidents were chosen: Arkansas, John E. Howell, El Dorado; California-North, Joseph M. Thomas, Bakersfield; California-South, Lawrence Vander Leck, Los Angeles; Colorado, Charles S. Hill, Denver; Illinois, David R. Stewart, Mattoon; Indiana, Ira Van Tuyl, Evansville; Kansas, R. B. Parriott, Wichita; Kentucky, George P. Ellison, Owensboro; Louisiana-North, W. O. White, Shreveport; Louisiana-South, E. G. Bateman, New Orleans; Michigan, J. W. Leonard, Mt. Pleasant; Mississippi, Donald M. Reese, Jackson; Missouri, O. G. Bitler, Kansas City; Montana, W. S. Croft, Cut Bank; New Mexico, F. J. Danglade, Lovington; Minnesota, Thos. A. Jirik, Faribault; New York-East, John M. Lovejoy, New York; New York-West, M. E. Mitchell, Wellsville; Ohio, Kenneth P. Millimen, Lancaster; Oklahoma-West, T. H. McCasland, Duncan; Oklahoma-East, Theo. N. Law, Tulsa; Pennsylvania, W. M. Shoemaker, Bradford; Texas-North, W. J. Weaver, Fort Worth; Texas-North Central, B. L. Woolley, Dallas; Texas-Northeast, Bryan W. Payne, Tyler; Texas-Panhandle, George B. Cree, Pampa; Texas-Permian, W. D. Noel, Odessa; Texas-Southeast, Harold Decker, Houston; Texas-Southwest, E. L. Ames, San Antonio; West Virginia, Paul Neuenschwander, Sisterville; Wyoming, Zach K. Brinkerhoff, Jr., Casper.

The following were elected committeemen: Creston Alexander, Dallas; O. C. Bailey, El Dorado, Ark.; George H. Bruce, Wichita, Kansas; T. Glenn Caley, Saginaw, Mich.; F. Allen Culver, Jr., Olney, Ill.; W. Ridley Wheeler, Fort Worth, Texas; Warwick M. Downing, Denver, Colo.; Paul Barnhart, Houston; Carl A. Johnson, Los Angeles, Calif.; R. C. Kay, Amarillo, Texas; R. G. Lawton, Magnolia, Ark.; F. B. Lefevre, San Antonio, Texas; M. R. McArthur, Cody, Wyo.; E. B. McGehee, Jackson, Miss.; Harry H. Nowlan, Evansville, Ind.; DeWitt T. Ring, Columbus, Ohio; Knight Thornton, Wellsville, N. Y.; Van S. Welch, Artesia, N. M.; Alden S. Donnelly, Midland, Texas; Joe Zeppa, Tyler, Texas.

Canadian Drilling Contractors Announce Officers for 1953

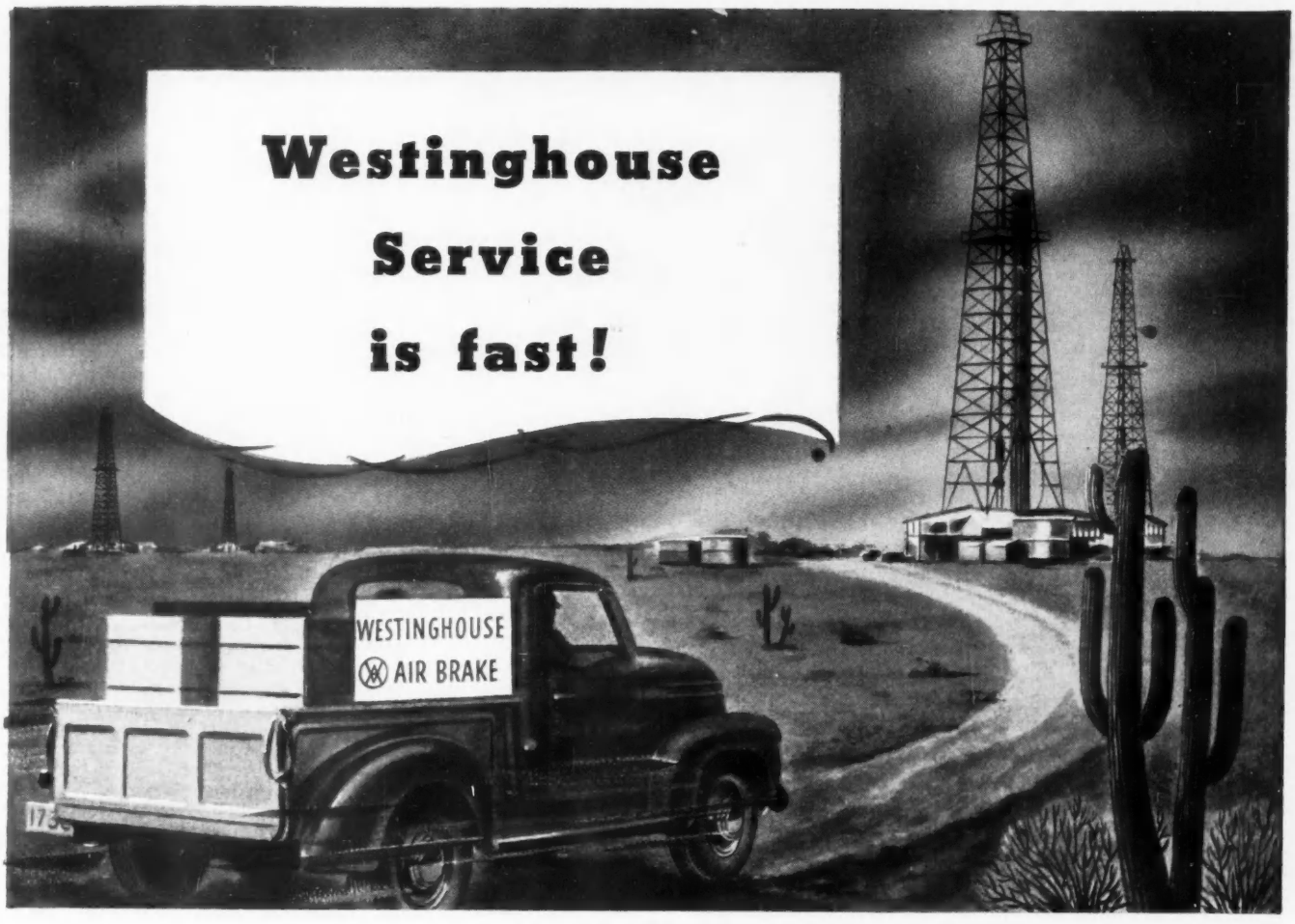
At the annual meeting of the Canadian Association of Oilwell Drilling Contractors, September 11, the following directors were elected for a one-year period:

Ted P. Bartlett, Arrow Drilling Company of Canada Ltd.; R. W. Brinkerhoff, Brinkerhoff Drilling Company Ltd.; William B. Crutcher, General Petroleums of Canada Ltd.; Gordon J. McKay, Commonwealth Drilling Company, Ltd.; E. E. Moore, Trident Drilling Company, Ltd.; C. A. Nabors, Parker Drilling Company of Canada, Ltd.; and Joseph W. Wark, McIvor Drilling Company Ltd.

Following the election of the new Board of Directors, the Board, on September 26, elected C. A. Nabors as president, and E. E. Moore as vice president of the association for the coming year.

Transportation Club Holds Annual Banquet in Chicago

The Transportation Club of the Petroleum Industry will hold its fifth annual banquet in the Walnut Room of the Bismark Hotel, Chicago, on November 10.



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LOOKING OVER the AIME, Houston chapter, program are William K. Whiteford, left, executive vice president of Gulf Oil Corporation, Pittsburgh; Paul Turnbul, La Gloria Corporation, and 1952 chairman of the AIME Petroleum Branch; and Claude R. Hocott, Humble Oil & Refining Company, newly elected chairman of the Petroleum Branch. Whiteford gave the welcoming address which opened the AIME meeting in Houston.

Oscar Chapman Heads Topflight Array of Speakers At API Meeting; Sessions Open Nov. 9 in Chicago

An outstanding array of topflight speakers representing government, business, the military, and all phases of the oil industry will be presented November 9-13 at the thirty-second annual meeting of the American Petroleum Institute when it meets in Chicago at the Conrad Hilton hotel. Last year's attendance totaled 5648 registrants and the 1952 attendance promises to break all records.

Oscar L. Chapman, secretary of the Interior and Petroleum Administrator for Defense, featured speaker in 1951, will be one of the two general session speakers. He will be joined by such outstanding figures as Frank M. Porter, president of API; Oveta Culp Hobby, co-publisher of the *Houston Post*, Senator William F. Knowland of California; and T. S. Petersen, president of Standard Oil Company of California.

L. S. Wescoat, president of The Pure Oil Company, Chicago, and chairman of the API board of directors, will preside at both general sessions.

Wednesday, November 12, the general session will be held in the Grand Ball Room and will include introduction of Porter, Wescoat and Chapman. A second general session is scheduled Thursday, November 13, same place, at which time Petersen, Mrs. Hobby and Senator Knowland will speak.

Other gatherings which will be held concurrently with the API meeting are the yearly dinners of the Transportation Club, the Pipe Liners Club, and the 25 Year Club.

The first meeting of the **Division of Transportation** will be a group session November 10, which will present: Vice Admiral W. M. Callaghan of the Military Sea Transportation Service, Washington, speaking on that branch of transportation service; P. C. Spencer, vice president of transportation will award the 1952 Certificate of Appreciation; B. Brewster Jennings, Socony-Vacuum Oil Company, New York; "The Effects of Competition on the Development of Transportation;" and John S. Burchmore, attorney, members of the Walter, Burchmore, and Belnap law firm, Chicago, "Government Regulation of Transportation." Elections will be conducted during this session.

On November 11, a morning group session will be held with R. B. McLaughlin, The Texas Pipe Line Company, Houston, presiding. J. R. Ellis, Sunray Pipe Line Company, Tulsa, will discuss "A Microwave-controlled Pump Station;" J. W. Lodge and G. K. Manning, Battelle Memorial Institute, Columbus, Ohio, will present "The Stress in Large-Diameter Gas-Transmission Pipe;" and R. G. Strong, Natural Gas Pipe Line Company of America, Chicago, and J. G. Norton, Magnolia Pipe Line Company, Dallas, will speak on "The New Pipe-Line Field Welding Code."

The Tuesday afternon session will present R. H. Lynch, Keystone Pipe Line Company, Philadelphia, speaking on "People, Pipe Lines, and Public Relations;" H. H. Anderson, Trans Mountain Oil Pipe Line Company, Vancouver, Canada, "Pipe Line Organization;" S. M. Blair, Trans Mountain Oil Pipe Line Company, Toronto, "Canadian Oil Production and Transportation;" and S. S. Smith, Shell Oil Company, New York, "Recent Products Pipe-Line Developments."

The Division of Transportation will hold the following committee and subcommittee meetings in the Palmer House: November 9: Subcommittee on Pipe Line Hydraulics, J. D. Peterson, Atlantic Refining Company, presiding. Subcommittee on Products Pipe Line Technology, J. W. deGroot, Tuscarora Oil Company, Ltd., presiding. Committee on Pipe Line Technology, H. H. Anderson, Trans Mountain Oil Pipe Line Company, presiding. Subcommittee on Pipe Line Construction Practices, J. C. Stirling, Service Pipe Line Company, presiding. November 10: Committee on Pipe Line Technology, H. H. Anderson, presiding. November 11: Central Committee on Pipe Line Transportation, R. B. McLaughlin, The Texas Pipe Line Company, presiding; Pipe Line Symposium, R. B. McLaughlin, presiding.

Only Transportation meetings will be held at Palmer House. All other API meetings are scheduled for the Conrad Hilton hotel.

First scheduled session for the **Division of Production** is an afternoon meeting November 11, to be presided by Glenn M. Stearns, British-American Oil Producing Company, Dallas, and W. L. McCloy, Jr., Standard Oil of Ohio Petroleum Company, Oklahoma City. J. C. Donnell II, vice president of production will present the annual Certificate of Appreciation at that time. Speakers will include: W. A. Bruce, The Carter Oil Company, Tulsa, "Use of High-Speed Computing Machines for Oil-Field Problems;" Lloyd E. Elkins, Stanolind Oil and Gas Company, Tulsa, "Importance of Organized Research in Drilling and Production;" R. C. Zell, Union Oil Company of California, Los Angeles, "Demand for and Supply of Tubular Goods—Present and Future;" and E. R. Brownscombe and A. B. Dyes, The Atlantic Refining Company, Dallas, "Water-Imbibition Displacement—A Possibility for the Spraberry."

Afternoon session on November 12 will be presided over by R. O. Garrett, Arkansas Fuel Oil Company, Shreveport, La., and George E. Cannon, Humble Oil & Refining Company, Houston. The program includes: Frank H. Willibrand, Standard Oil Petroleum Company, Oklahoma City, "Supervisory Development;" S. F. Bowlby, Shell Oil Company, Los Angeles, "Significance of the Williston Basin;" Ralph E. Davis, consultant, Houston, "Natural Gas in An Expanding Economy;" H. H. Healy, The Ohio Oil Company, Casper, Wyo., Report of Division's nominating committee, followed by election of general committee members.

API Flight Schedules

Chicago and Southern Air Lines
Lv Houston 8:05 a.m.
Arr Chicago 1:08 p.m.
2:00 p.m.—1:08 p.m.
(This special flight is already filled)
3:00 p.m.—7:15 a.m.

Braniff International Airways
Lv Houston 7:30 a.m.
Arr Chicago 12:55 p.m.
10:40 a.m.—3:25 p.m.
5:25 p.m.—10:10 p.m.
Lv Oklahoma City 1:35 p.m.
Arr Chicago 3:25 p.m.
5:40 p.m.—9:50 p.m.
2:45 a.m.—7:15 a.m.
Lv Tulsa 12:25 p.m.
Arr Chicago 5:25 p.m.
6:47 p.m.—9:50 p.m.

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The odds are very much in your favor that you can produce your new-design products faster, stronger and more economically with TESCO steel castings. As an added service, TESCO has established a product engineering department to work with manufacturers and design engineers while their products are still in the development stage.

Let us show you case histories of how this added TESCO service has worked to the advantage of other Gulf Coast manufacturers. Do you have a product in mind now? Call us!

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News of Service and Suppliers

MEETING TO STANDARDIZE the spooling of wire rope at a conference called by LeBus International Engineers, Ltd., the following manufacturing, engineering and press representatives discussed the problems involved: left to right, front row, Bob Pigg, N. K. Ellis, H. C. Garlick, Jack LeBus, J. T. Carmichael, F. L. LeBus, Sr., F. L. LeBus, Jr., Ted Workman, Mel Anderson, and Charles G. White. Second row: Walter C. Richards, George S. Jackson, John Stammer, Ben Corley, L. R. Saunders, Marvin Peck, Edwin Walker, Russell Moore, Joe DonCarlos, Lonnie Thompson, Jay D. Dillon, Joe M. Gready, T. H. Gibbs, Glen Mason, B. M. Ashbaucher, and W. C. Jones. Third row: J. E. Miller, John W. Jacoby, Oscar Albritton, J. E. Hamiter, Ed H. Fisher, Earl Calk, J. B. Harder, Fuller Rogers, W. G. Harman, E. L. Cole, Max Green, Ken Slough, Leonard Doss, Woodward Williams, R. D. Cloninger, Jake Tipps, Jesse Calk, and John J. Dean.

WIRE LINE CONFEREES enjoyed an evening's social after deep thinking sessions at the meeting called by LeBus International Engineers, Ltd., to discuss methods of standardizing wire line spooling. Left to right: W. C. Richards, J. E. Hamiter, Max Green, J. M. Gready, Jake Tipps, Charles G. White, B. M. Ashbaucher, Frank L. LeBus, Sr., Ed Fisher, L. R. Saunders, T. H. Gibbs, W. O. Harman, and John J. Dean.

BS&B Winds Up Huge Expansion To Celebrate 60th Anniversary

Black, Sivalls & Bryson, Inc., nearing completion of a $2 million expansion of plant facilities at Oklahoma City, Kansas City, and Odessa, Texas, recently completed its sixtieth year of continuous operation. From its beginnings in Ohio as a small company building wood tanks for oil storage, BS&B has expanded into a company operating six manufacturing plants and 52 branch and sales offices.

This international business successfully introduced several new oilfield products during its sixtieth year, a new horizontal emulsion treater, a glycol injection low temperature separation system, a single lease stabilizer, designs on small packaged gasoline plants and a glycol type gas dehydration plant.

Montana Sales Office Opened

Maloney-Crawford Tank & Manufacturing Company of Tulsa has opened a branch sales and service office at Glendive, Mont. Frank B. Matthews has been transferred from Edmonton, Canada, to manage the store under the direction of G. M. Cheatham, vice president of Maloney-Crawford of Canada, Ltd.

English Manufacturer Contracts For IDECO Products in England

Dr. Hans Berger, of Zurich, Switzerland, director of Dresser Atkiengesellschaft, has announced that Woodfield Hoist & Associated Industries Limited of Rochester, England, will manufacture IDECO oil field machinery and equipment in England. Dresser Atkiengesellschaft is a European subsidiary of Dresser Industries, Inc., of Dallas.

Woodfield is a prominent British manufacturer of equipment for drilling, workover and servicing.

Westinghouse Air Brake Company Establishes Research Laboratory

Westinghouse Air Brake Company has established a Research Laboratory to serve domestic and foreign subsidiaries of the company. Thomas Meloy, president of Melpar, Inc., Alexandria, Va., a subsidiary company, has been named director of research of the Westinghouse Air Brake organization.

Melpar, Inc., in addition to the work for Westinghouse Air Brake Company, currently has research and developement contracts in the fields of radar, sonar, computers and communications.

LeBus Accepts Leadership To Standardize Spooling Methods

LeBus International Engineers, Ltd. recently called a conference of equipment manufacturers, wire line manufacturers and representatives of industry at Longview, Texas, to discuss the problems involved in wire line spooling. LeBus at that time introduced plans for a handbook which they would edit on wire line spooling. After discussing proposed material they called on the conferees for comment and suggestions. The purpose of the meeting was to introduce procedure to fit the varied requirements met throughout all phases of industry.

Following the technical discussion the representatives at the meeting were entertained at the home of Frank LeBus, Jr.

Reed Roller Bit Company Names William L. Childs Sales Manager

It was a happy 38th birthday for William L. Childs on October 23. Not as a birthday present but as a part in a long line of promotions with the Reed Roller Bit Company, announcement was made by vice president Rex G. Hamaker that Bill Childs had been made sales manager of the Oiltool division of the company.

William Childs

Bill Childs has worked with Reed Roller Bit Company since 1925 when his father, Bert Childs, then general manager of Reed, put him to work in the plant to "keep him out of mischief." Of course there was some time out for prep school and college—Culver Military School where he was graduated in 1931, Kemper Military School where he finished junior college work in 1933.

Upon graduation from the University of Texas in 1939 with a degree in petroleum production engineering, he went to work formally with Reed, being assigned to the sales-service department in California. In 1940 he was transferred to special work in the research department in Houston, and late in 1940 was moved back into the sales department with headquarters in Chicago.

Then the Army got him, as a second lieutenant, assigned to the Fuels Storage Section of the Air Corps. He later became chief of the section and when he was released from the army in 1946 it was with the rank of lieutenant colonel.

Returning to Reed, he worked in the sales department in various capacities—sales engineer, district sales manager at Shreveport, organizer of the Canadian sales division and district sales manager of the Gulf Coast Division at Houston until his promotion as sales manager of the Oiltool division.

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BUT...when the SUCCESS of your well s at stake...correlating CURVES of ny kind is *mighty risky business!*

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ONLY PGAC's Simultaneous Radiation Log . . . simultaneously records the Gamma Ray and Neutron/Neutron curves — absolutely interlocked with a positive depth indication — ***on a single trip in the hole.***

ONLY PGAC's Simultaneous Radiation Log . . . uses the superior Neutron/Neutron method for pin-point accuracy—thereby avoiding the detrimental effects of Neutron/Gamma methods used for all competitive radioactivity logging of the Neutron curve.

ONLY PGAC's Simultaneous Radiation Log . . . permits the big savings in rig down-time resulting from a single trip in the hole — instead of the usual two or more trips — for radioactivity logging.

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THERE'S NO SUBSTITUTE . . . . for PGAC's Simultaneous Radiation Log

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* Play it safe—always call in PGAC for logging. You'll get a safer log, faster service—and you'll enjoy big savings in rig down-time!

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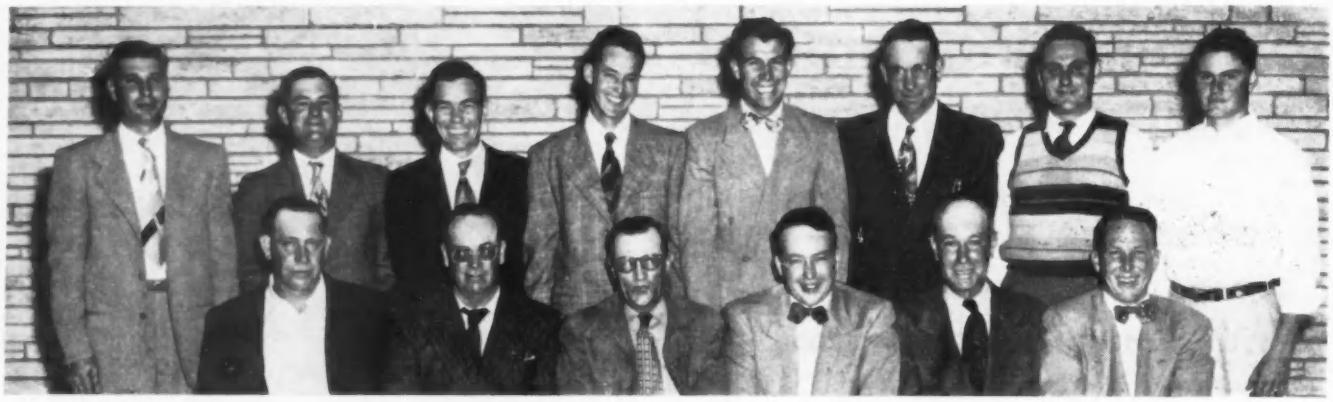

EXPLORATION & DRILLING COMPANY safety contest winners with no lost-time accidents during a year, are, first row, left to right: L. G. Walker, Driller J. L. Travis, Toolpusher Dick Hodges, Driller E. M. Farr, Driller Henry Yancey, and R. J. Farr. Back row, left to right: H. B. McGee, L. C. Finley, E. A. Newell, J. S. Dickey, J. D. Guinn, E. A. Bullard, G. Rodgers and C. M. Rodgers. W. E. Sample was absent due to illness. The runnerup crew, supervised by Drilling Superintendent C. J. Matthews and Toolpusher E. Wing, were drillers J. B. Goodwin, Mack Jackson and B. F. Phillips; derrick and enginemen L. L. Brady, C. R. Pyle, C. Conners, Sam Loftis and E. C. Roemmich; and helpers C. E. Wenner, E. O. Jones, D. Shelabarger, L. A. Joseph, E. B. Lyday, and R. W. Coburn.

New York Belting, L. H. Gilmer Combine to Form New Organization

The New York Belting & Packing Company has joined forces with the L. H. Gilmer Company. The new organization will continue to operate and be known as New York Belting & Packing Company, but Gilmer products, including V-belts, flat belts, "timing" belts and shock pads, will retain the Gilmer name.

B. F. Ruether, vice president of New York Belting & Packing, will be in charge of the expanded organization.

New National Bank Opening Soon In Houston's River Oaks Area

A new national bank is to be opened soon at 1968 West Gray, Houston, according to the comptroller of the currency of the United States who has approved establishment of the bank. The first national bank to be chartered in Houston since 1934, it will be called the American National Bank of Houston and will have a capital structure of $350,000. The bank will be a member of the Federal Deposit Insurance Corporation.

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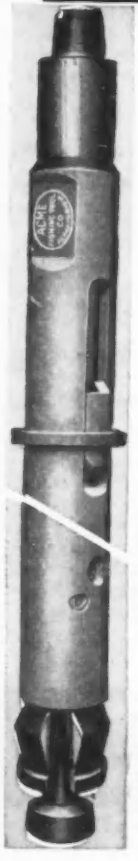
. . . to-be-Sure—Always Ask for Acme's Underreamer . . .

Acme's Underreamer increases hole size below casing, to lower casing and shut off water or cave-in. Reams faster. Avoids key-seating. Rounds out flat hole. Acme's exclusive 3-cutter unit assures advantages over 2-cutter types. Unique construction assures solid backing while reaming. Cone seats firmly around cutters, inside. Better cutting gauge. Keeps out dirt.

Cutters collapse (see cut) for "free and easy" in-and-out of hole. Expand for underreaming. No jarring into casing. No broken cutters. Body 1-SOLID forging. Hard surfaced cutting edges. All parts PREMIUM-grade steel; correctly heat-treated and precision machined, for maximum service.



See Acme's Insert in 1951 Composite Catalog. Also write for more complete Catalog, containing valuable cable tool "use and care" manual.

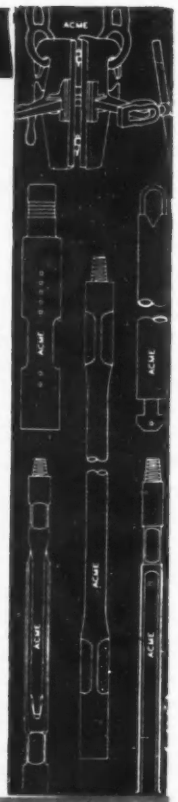


Fig. 142 — Acme 3-cutter Underreamer. 51-years' specialized "know-how" makes it worth more to YOU.

ACME DRILLING & FISHING TOOLS

ACME FISHING TOOL CO.
PARKERSBURG W. VA.
Export Office:
19 Rector St., New York 6, N.Y.

Franks Manufacturing Uses Films to Sell Oil Service

Two technicolor sound films are being produced for Franks Manufacturing Corporation, Tulsa, to demonstrate new 1953 models of portable well servicing and workover units.

The first film already completed, "The Cruiser Story," includes shots of many West Texas well servicing contractors participating in a barbecue which was held for them at Odessa, Texas. In order to get films of the units in actual operation, cameramen have been flown to various fields near Franks district sales and service offices, Texas, California, Wyoming, Oklahoma, and Edmonton, Canada. Similar films on Franks "Rocket" and "Comet" lines are still in production.

Trans-Texas Airways Celebrates Fifth Year of Commercial Service

Trans-Texas Airways, a local service airline operating exclusively within the state of Texas, celebrated its fifth anniversary, October 11. The young airline was certificated as a commercial local service carrier in November, 1946, and service started on October 12, 1947.

To date, Trans-Texas Airways has flown 64,269,000 revenue passenger miles; boarded 273,910 revenue passengers; flown 13,072,00 revenue plane miles; 249,981 ton-miles of mail; and 332,937 cargo ton miles. Service includes flights from Corpus Christi to Mission-McAllen-Edinburg; Fort Worth-Dallas to San Angelo; Dallas to Beaumont-Port Arthur.

Ajax Iron Works Celebrates 75 Years of Engine Building

Commemoration of 75 years in business was noted this fall by Ajax Iron Works, manufacturers of Ajax gas engines. An inspection of the plant, a reception and open house marked the celebration. Ajax is reputed to be the oldest continuous engine builder in the U. S. In the post war period, Ajax has re-tooled, re-equipped and greatly expanded its plant facilities and its specialized products are distributed all over the world by firms engaged in oil production.

National Builds Williston Store

Increased drilling in the Williston Basin has prompted The National Supply Company to build a permanent store building at Williston, N. D., to replace its temporary store. Walter F. Smith is manager of the temporary store.

The Western Company Appoints Myers Assistant Vice President

J. L. Myers has been named assistant vice president and Ralph E. Smith has been made manager of the Employe Relations department of The Western Company.

J. L. Myers

Jack Benefield has joined the staff of Western's Employe Relations department as editor of the employe publication, *The Western Brand.*

Myers has been with the company for 1½ years and was first a sales representative in the Panhandle-Western Kansas area with headquarters in Borger. In September, 1951, he was made manager of the Employe Relations department and transferred to Western's general office in Midland.

Myers will supervise the Employe Relations department, serve as secretary to the company's executive committee and supervise various management projects.

Smith joined the staff of the Employe Relations department in November, 1951, as training supervisor. As manager of the department he will direct all phases of Western's employe program.

Smith formerly was training and personnel supervisor for Shell Oil Company's Houston refinery.

Benefield was oil editor for the Lubbock *Avalanche-Journal* before joining Western.

Beckman Instruments Appoints W. H. Steinkamp Vice President

Beckman Instruments, Inc. has appointed William H. Steinkamp vice president and general manager of sales for the company. Steinkamp has been associated with the Brown Instruments Division of Minneapolis Honeywell Regulator Company for the past 22 years as general sales manager in Philadelphia. Steinkamp will make his headquarters at South Pasadena, Calif. Beckman Instruments is engaged in a program to broaden the distribution of products of its several divisions.

W. H. Steinkamp

Cooper-Bessemer Adds Hensley In Expansion of Tulsa Office

Robert E. Hensley has been appointed to Cooper-Bessemer Corporation offices in Tulsa to work under the direction of Byron L. Potter, branch manager. Hensley will concentrate on engineering the installation of diesel engines, gas and air compressors for pipe lines, etc., in the Oklahoma area. An engineering graduate of Oklahoma A. & M., Hensley received specialized training in engine and compressor operation at the company's headquarter plant in Mount Vernon, Ohio.

Published September 1952

OIL & PETROLEUM YEARBOOK

1952

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43rd Annual Edition

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The book is invaluable to everybody interested in this important industry, its contents comprising complete up-to-date and reliable particulars concerning companies interested in all branches, Producers, Refiners, Transporters, Finance, and Oil Dealers.
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AMERICAN, CANADIAN, BRITISH AND FOREIGN COMPANIES

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Distribution of the new 19th Edition of *Composite Catalog of Oil Field and Pipe Line Equipment* will be underway soon.

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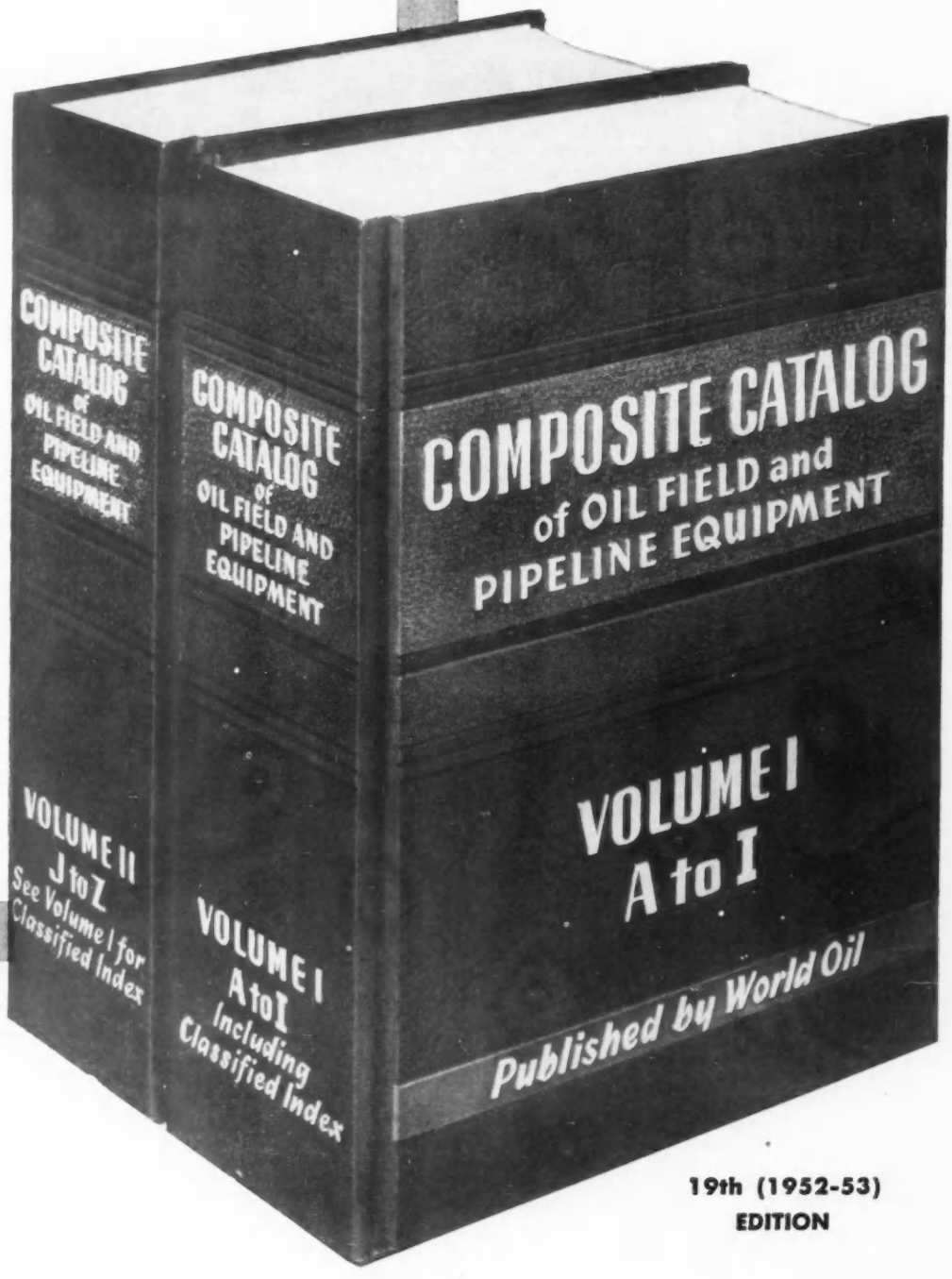
What oil men like in catalogs is reflected in these two volumes as never before. We continually solicit oil men as to the type of catalog information and method of presentation you want most. What you tell us is used by the manufacturers and service companies to improve the usefulness of their catalogs to you.

We know you will find this new *Composite Catalog* more useful, more complete than ever before. Your comments are invited.

THE NEW 19th COMPOSITE CATALOG


COMPOSITE CATALOG of OIL FIELD and PIPELINE EQUIPMENT
VOLUME I A to I
Published by World Oil
COMPOSITE CATALOG of OIL FIELD AND PIPELINE EQUIPMENT
VOLUME I A to I Including Classified Index
COMPOSITE CATALOG of OIL FIELD AND PIPELINE EQUIPMENT
VOLUME II J to Z See Volume I for Classified Index

19th (1952-53) EDITION

USE THIS UNIVERSAL EQUIPMENT GUIDE

Engineering Building Dedicated By International Harvester Company

International Harvester Company recently dedicated a new $8 million motor truck engineering building and laboratories in Fort Wayne, Ind. Built for the company's motor truck division, the new operation is situated on 25 acres of ground on Meyer Road just off U. S. Highway 30. The engineering department and laboratories are adjacent to the company's Fort Wayne Works, one of four motor truck manufacturing operations in the Harvester motor truck division.

W. D. Reese, manager of engineering for the motor truck division, and P. T. Brantingham, assistant manager of engineering, are the administrative heads of the new operation.

Walter Maranuk Named Executive Of Baker-Raulang Distributor

The Baker-Raulang Company has added Walter S. Maranuk to its Detroit staff as a vice president of H. A. Stevenson, Inc., distributors of Baker industrial trucks in Michigan. Prior to joining the Baker organization, Maranuk spent five years in the Michigan territory as sales engineer for a distributor of material handling products. He has a background of more than a decade in the material handling industry, including sales and engineering positions with Yale & Towne Manufacturing Company.

HALLIBURTON OIL WELL Cementing Company officials inspect the site of the firm's Technical Center at Duncan, Okla. Left to right: Chief engineer John Guest, architect Frank Hogwood, vice president and secretary-treasurer Logan D. Campbell, president W. R. McClendon and coordinator R. M. (Dick) Hansen. In background are Halliburton Plant Two buildings.

Lawrence Straw Heads Bendix' New Mobile Sales Organization

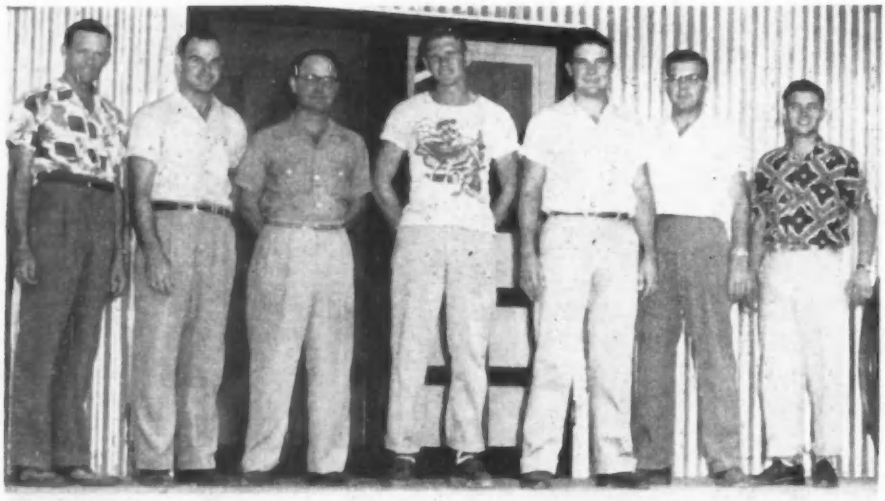
Lawrence J. Straw has been named mobile sales manager of the Bendix Radio Division of Bendix Aviation Corporation and will head up a newly created national sales engineering organization, selling the Bendix line of two-way radio and communications systems. Straw joined Bendix in February 1952, having previously been associated with Capehart-Farnsworth as service manager and as assistant to the general manager of the Technical Products Division.

American Blower Names Head Of New Compressor Section

R. L. Bernhard, recently named manager of the newly-created Centrifugal Compressor department of the American Blower Corporation, is a graduate of University of Alabama and brings to American Blower more than 18 years of experience in the centrifugal compressor field.

R. L. Bernhard

American Blower established a separate compressor department to streamline operations for prompt and efficient service in centrifugal compressor equipment items.



OPERATING THE NEW SEMINOLE, Okla., store for Mid-Continent Supply Company, the staff took time out for a group picture. W. H. Haney is manager and his field salesmen are D. E. Rowe and T. R. Wilson. Storemen include J. D. Brown, H. R. Gamble, D. O. Jackson and S. L. Rooker. The store is located on U. S. Highway 270 and is surrounded by a paved parking area.

Collett Heads Irrigation Section For Stewart & Stevenson Services

W. B. Collett has been appointed manager of the newly expanded irrigation division of Stewart & Stevenson Services. He will make his headquarters in San Juan.

W. B. Collett

The irrigation division serves all of Texas. The new division has been expanded to provide better service for Stewart & Stevenson customers throughout the state.

National Supply Announces Canadian, Louisiana Offices

The National Supply Company organization has expanded its activities in Harvey, La., and Regina, Saskatchewan, Canada. At Regina the organization has opened a sales office on Scarth Street which will be directed by James H. Linstead.

At Harvey, a larger supply store has been erected. It includes sales offices, warehouse facilities, a dormitory and storage yard for bulk equipment. This store is managed by K. H. McFann under L. A. J. Monroe, district manager.

NOTICE: Specify **PELCO** Welding Saddles

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SEE YOUR NEAREST SUPPLY HOUSE

(Formerly: Pelican Well Tool & Supply Co.)

RECEIVING INSTRUCTION on how to assemble a Gorman-Rupp pump, Lee Francis of the Henry H. Paris organization, listens to Viron Broach of the Gorman-Rupp Company. Gorman-Rupp is instructing all Henry Paris representatives to enable them to sell and service the pumps to the best advantage.

Jones & Laughlin Vice President Retires After 39 Years Service

Robert McCoy, Jr., a vice president of Jones & Laughlin Supply Company who had been with the firm 39 years, has retired. McCoy went to work for Frick-Reid Supply Company (now Jones & Laughlin Supply Company) in 1913 as a storeman at Cushing, Okla. After working at Cushing and later at Drumright, Okla., in 1929 McCoy was named sales manager of the company's Western division at Tulsa. His election as vice president and director came in 1938.

Robert McCoy, Jr.

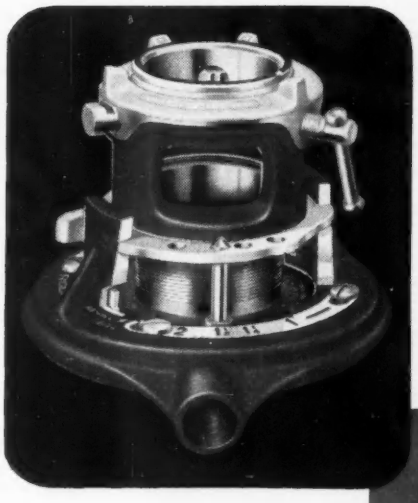
Goodall Rubber Opens Odessa Warehouse Under A. O. Wells

Goodall Rubber Company of Texas has opened a warehouse in Odessa which will carry complete stocks of rotary hose, pump suction and vibrator hose. A. O. (Pappy) Wells, West Texas oil equipment salesman, has been named West Texas representative and will make his headquarters at the Basin warehouse. Wells, formerly with Patterson-Ballagh, will contact both supply stores and drilling contractors.

A. O. Wells

John Garratt, who formerly represented Goodall in the West Texas area, will continue to be in charge of the territory, but will make his headquarters in Houston. It is expected that Goodall will soon establish a rotary hose repair department in Odessa similar to the shop in Houston.

For *Extra* Fast Easy Smooth Pipe Threading Choose RIDGID



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JAM-PROOF 65R
Perfect threads on 1″ to 2″ pipe with 1 set of 4 high-speed steel dies—sets to pipe size in 10 seconds. Lead screw on barrel won't jam on workholder—drive plate automatically kicks out driving pawl. Self-centering workholder sets instantly!

4P GEARED THREADER
For 2½″ to 4″ pipe. Balanced loop handles—easy to lift 4P where you want it. Mistake-proof workholder sets to size before put on pipe—1 set screw. Safe enclosed gear. Practically no upkeep. Special 4P for conduit.

OOR RATCHET THREADER
For ⅛″ to 2″ pipe. Heads snap into ratchet ring from either side, won't fall out. Precision-cut alloy dies reverse for close-to-wall threads. 00R and 0R, ⅛″ to 1″; 111R and 11R, ⅛″ to 1¼″; 12R, ⅛″ to 2″. Conduit dies, too.

EXTRA VALUE
RIDGID's are famous for efficient design, smooth performance, rugged durability. Every die stock factory tested. For top value for your money, buy RIDGID threaders from your Supply House.

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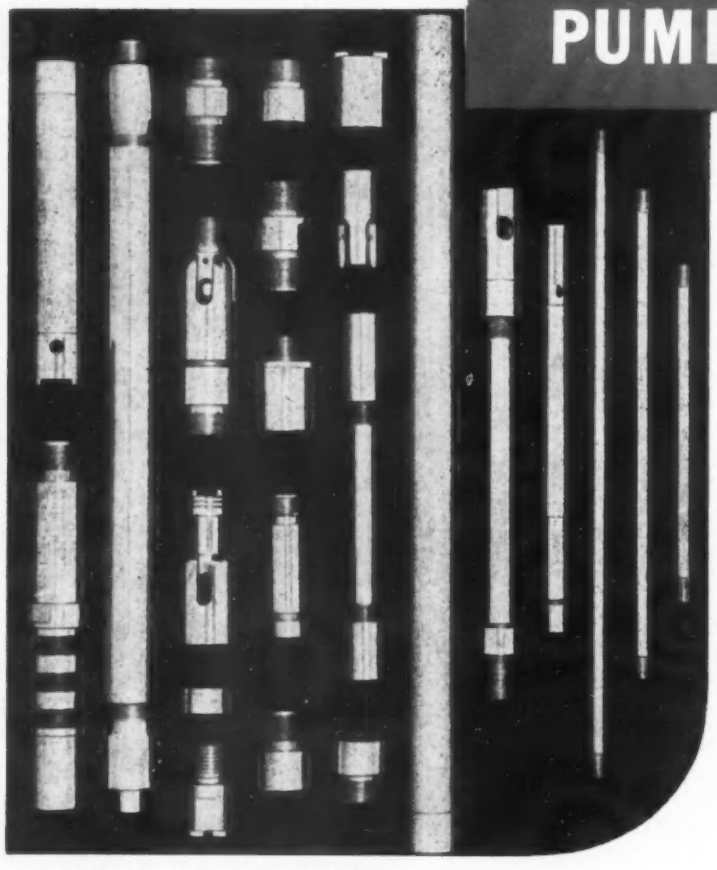
PACIFIC *Precision Built* **OIL WELL PLUNGER PUMPS**



These Pacific Parts Will Assemble Six Different Types of Oil Well Plunger Pumps.

Pacific Moloy® sectional plungers are designed and finished so that when worn on the outside diameter they can be used as sectional liners without remachining.

Pacific plungers, ball valves, seats and cages, many bushings, adapters and fittings are interchangeable between types. Hold downs are interchangeable between types and between top and bottom.

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Oil Well Supply Names Goetzinger To Vice President-Treasurer Post

G. F. Goetzinger has been appointed vice president-treasurer of the Oil Well Supply Division of United States Steel Company.

G. F. Goetzinger

Goetzinger joined the company in 1914 as a clerk in the Credit department. All of his service and experience has been concerned with the credit and financial aspects of "Oilwell's" business. He was named credit manager for the Eastern area, Oil City, Pa., in 1932. In December, 1942, he was promoted to assistant treasurer and while in that capacity was transferred to the Dallas headquarters in April, 1944. In 1946, he was appointed treasurer and general manager.

Harry F. Vickers

Kenneth R. Herman

Sperry Corporation Votes Vickers And Herman to Executive Positions

Harry F. Vickers, founder and president of Vickers Inc., was elected president of The Sperry Corporation to succeed Thomas A. Morgan, retired. Vickers' association with The Sperry Corporation began in 1937 when Vickers Inc. became a Sperry subsidiary.

Kenneth R. Herman, vice president and general manager and a director of Vickers Inc., was elected vice president of The Sperry Corporation. Herman has been closely associated with Vickers since 1931, one year after Vickers Inc. was formed.

Both men will also continue in their present capacities at Vickers Inc.

Doyle Tucker Is Assigned to Handle Totco Service in Williston Basin

Doyle Tucker has been transferred by Technical Oil Tool Corporation to Williston, N. D. With Tucker, Totco now has three men serving the Rocky Mountain area through the Continental Supply Company stores. These men are located in Casper and Cody, Wyoming and at Williston.

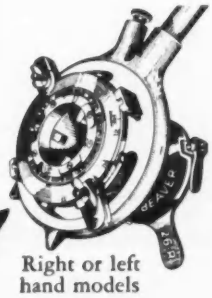
Doyle Tucker

Tucker, who has been with Totco at Snyder, Texas, will continue to work under the direction of E. G. McConnell, Totco Mid-Continent manager.

SIMPLICITY!

Low Upkeep Cost
Trouble-Free

BEAVER NO. 26-R
1 TO 2-INCH PIPE THREADER



Right or left hand models

5 OUTSTANDING ADVANTAGES

• The new Beaver 26-R is a greatly improved and simplified successor to the "old Beaver 26," popular for 40 years. Drive ring is on top—in line with dies for easy cutting. Oversize, undersize or standard threads can be cut of uniform length. Has "radio dial" setting. Change size in 2 seconds without tools. Standard taper or electric conduit threads. One set dies. No bushings.

Radio Dial Setting Change in 2 Seconds

Dies Easily Removed from Outside

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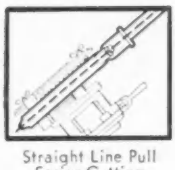
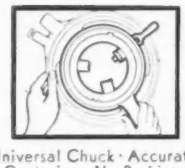
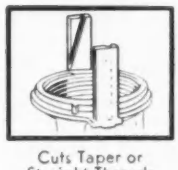
254-300 DANA AVENUE • WARREN, OHIO, U. S. A.
"Over 50 Years of Friendly Service"



Straight Line Pull Easier Cutting



Universal Chuck · Accurate Centering · No Bushings



Cuts Taper or Straight Threads

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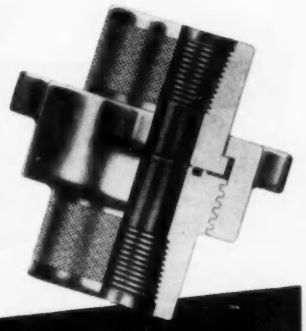
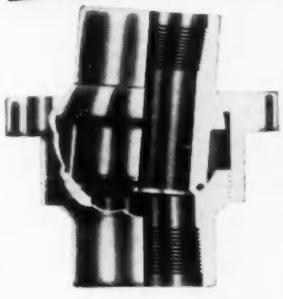


Furnished in all popular sizes and pressure ratings to meet the vast majority of your requirements. Dependable O-Ring seal holds positively against pressure or vacuum, in oil, gas, steam, mud and water services. Flat face permits straight-away breakout.

A Complete Selection of Unions That Give You Greater Security and Economy Under All SERVICE CONDITIONS



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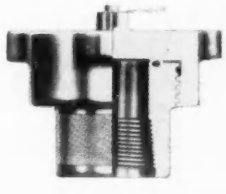
The new standard of the pipeline industry, with lighter weight, easier handling and greater security provided by the modern 2-piece design.



2-PIECE MANIFOLD

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■ Well drills, spudders, rotaries, core-drills. All sizes new and used equipment. Tools, drill pipe, cable, pipe. Fishing tools rented. Everything for well drilling. Pressey & Son, Pueblo, Colorado.

■ TWO 150 horsepower F and T boilers located at Eunice, New Mexico. Makin Drilling Co., Box 131, Hobbs, New Mexico.

■ FOR SALE: Producing oil minerals in Williston Basin, Montana, also 120 acre lease in gas distillate area of Louisiana. P. O. Box 1761, Monroe, La.

■ 94' Cantilever Drilling Mast, Heavy Duty, can be converted to triple 126' mast by adding conversion section. Base 36' long. Mast like new. Carl W. Johnson, Phone 6321, Box #381, Great Bend, Kansas.

FOR SALE OR LEASE

■ Longest established Pipe and Supply yard in the heart of the South Texas oil fields—consisting of ten acres of land—office building (with living quarters)—shop (two pipe machines)—warehouse—storage building. Out of the city limits on main highway. If interested write Box 1495, Alice, Texas. Phone 525, 2358 or 264J.

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■ Assistant Controller—Integrated Oil Company in Mid-Continent area is seeking an experienced Assistant Controller. Position requires top-level man with experience in oil, systems and costs. Please submit resume which must give complete data on experience, salary requirement, and personal history, including education, background and associations. Box 61-W, c/o WORLD OIL, Houston, Texas.

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■ **WE WILL BUY Producing Oil Royalties. Send Particulars. Standard Security Co., 111 Broadway, New York 6, New York.**

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Established sales organization operating in Texas, Louisiana and Southern Arkansas is in position to represent an additional manufacturer. Sales personnel includes graduate engineers. Active representation assured by experienced personnel already well acquainted and successfully serving the petroleum industry. Box 63-W, c/o WORLD OIL, Houston 1, Texas.

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■ Geologist, MS, twelve years exploration, production and administrative geological experience with major and small companies. Presently employed in responsible position but desires connection with active independent or drilling firm. A high percentage of deals recommended have found oil. Let me evaluate, develop and promote your deals. Oklahoma location. Write 62-W, c/o WORLD OIL, Houston, Texas.

Drilling contractor operating in West Texas and New Mexico desires to contact small or medium-sized independent oil company who needs an operating manager. Personal interview desired. Twenty years experience in all phases of the oil industry. Address replies to Box 94-W, WORLD OIL, Houston 1, Texas.

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TRUCK LETTERING AND TRADEMARK decals made for your trucks. Easy to apply, uniform, distinctive, economical for small or large needs. Write for Catalog. Mathews Company, 827 S. Harvey, Oak Park, Ill.

Stratoflex Opens Quarters At Fort Worth, Los Angeles

Stratoflex, Inc., manufacturers and distributors of detachable reusable fittings and flexible hose assemblies have opened a new sales office in Los Angeles, and have made several important personnel transfers and promotions in the organization.

Formerly operating as Aeroquip Sales and Engineering, Inc., Stratoflex, has now moved into its new quarters in Fort Worth. District offices are located at Houston and Odessa, Texas; Birmingham, Ala.; Kansas City; Wichita, Kansas, and Los Angeles.

J. D. Willis, former manager of the customer's order section and purchasing agent at Fort Worth, is now office and warehouse manager at the same location.

K. G. Hibben, employe of the Fort Worth purchasing department, has been promoted to sales representative at Birmingham, replacing H. W. Priest, sales engineer, who has been transferred to the company's Wichita office.

Another employe of the Fort Worth purchasing department, B. L. Matheson, has been promoted to sales representative at Houston, replacing A. B. Quinn, sales engineer at that office since 1950, who has been transferred to Los Angeles.

Johnston Pump Company Acquires New President in Thomas Simmons

Thomas W. Simmons, Jr., was elected president and general manager of Johnston Pump Company. Simmons was formerly vice-president and general manager of the pump concern.

T. W. Simmons, Jr.

Other directors of the company are Mrs. Mabel C. Simmons, chairman of the board; Earl Hupp, who is also secretary-treasurer; Charles L. Holbert, vice-president in charge of finance; and Warren S. Pallette, general counsel.

E. H. Wilkins

Vance Sibley

Permian Basin Well Servicing Firm Organized by Sibley and Wilkins

E. H. (Doc) Wilkins has been named vice president of Vance Sibley & Company, oil well servicing concern with headquarters in Levelland, Texas, it has been announced by Vance Sibley, president. It was also announced that a new company, Sibley & Wilkins, Inc., Drilling Services, has been formed with Sibley as president and Wilkins as vice president.

Operations of Vance Sibley & Company include general well servicing and remedial work. The new company will specialize in completion drilling and operations will be concentrated in the Lubbock-Levelland area.

Before forming Vance Sibley & Company, Sibley was district superintendent for Stanolind Oil & Gas Company for the Odessa and Levelland districts.

Wilkins had been with The Western Company since 1942. Immediately before joining Vance Sibley & Company, Wilkins was a sales representative for Western in Lubbock.

Headquarters for both companies will be in Levelland and their services will be offered throughout the Permian Basin.

Wagner Electric Is Expanding Transformer Plant At St. Louis

Wagner Electric Corporation, St. Louis, recently purchased additional ground and buildings which adjoined the Wagner plant, from Fulton Iron Works Company. The land and 100,000 square feet of floor space enclosed in the buildings will be used to increase Wagner's transformer manufacturing capacity. Completion of the planned expansion and conversion program will cost more than $1 million and take a year to complete. When finished, production of large power transformers will be centralized in the main transformer shop.

New Books, Maps and Movies

A TEXAS WILDCATTER, A Fascinating Saga of Oil. Lucille Glasscock. The Naylor Company, San Antonio, Texas, Texas. $2.50.

"Nothing was as cold as yesterday's headlines." So spoke Gus Glasscock who at 21 found himself a has been. The nimble body and feet which had brought him great fame as a circus performer were refused by the U. S. Army in 1917 for failing to measure up to physical standards! Glasscock moved on to Ranger, Texas, where he worked as a mule-skinner, a tool-dresser and finally derrick work. Seeking some of the fortunes which were being made overnight, he bought a "piece" of a wildcat. It turned out a duster.

Wichita Falls proved another Ranger for Glasscock but he was learning. At Somerset he—and his syndicate—brought in five producers—and a dry hole. When the vast underground reservoir that was East Texas finally came in, Glasscock decided to gamble—and won. But Glasscock's dream of oil carried him further. He dreamed of oil under the sea and gambled again. This story is recounted in a candid, searching manner which clears up many distorted notions concerning Texas and the petroleum industry.

THE DICKY BIRD WAS SINGING, Bob Duncan. Rinehart & Company, Inc. 232 Madison Avenue, New York 16. $3.

A collection of stories about a highly diverse collection of people, the characters portrayed all have one thing in common, the mad, crazy, desperate dream of oil. Oil, America's newest, most fabulous industry, already has a past filled with myths, legend, folklore and tall tales. The dicky bird, made of cast iron and with the rasping song of the derrick's walking beam, is oil's spokesman. The motley gallery of men and women who listened to the dicky bird and joined the ever widening search for oil are immortalized by a rare story-teller and humorous scholar.

SPINDLETOP, James A. Clark and Michel T. Halbouty. Random House, New York. $3.95.

This saga of the famous Spindletop Field is compiled in a most pleasing presentation by the authors. Unlike most books dealing with a historical event, this book is not only good reading but will serve as a future reference book for accurate historical information on the petroleum industry. The authors indicate by the facts presented that they have made a thorough study of all available information on the great Spindletop Field and all events leading up to this famous discovery which changed the world.

This is a fascinating tale of men against odds, and the incidents which molded men and ideas together to form the nucleus of the modern oil industry. Further, it is brought vividly alive by its colorful portraits of the men who played a part in this great adventure.

Written by men who have known the field all their lives, *Spindletop* reveals the whole story of the discovery that inaugurated the rise of America to dominant world power and helped its people to security and the abundant life.

PETROLEUM DICTIONARY AND PRODUCTS MANUAL. Petroleum Educational Institute, 9020 Melrose Avenue, Los Angeles. $8.

The Petroleum Educational Institute has a two-fold purpose in editing this book. Information useful to sellers, buyers and consumers of petroleum products is given. Also, the volume provides a dictionary of terms commonly used in the petroleum and other industries in connection with petroleum. Prepared on an elementary level and containing illustrations, it is especially designed for those who do not possess a technical background in petroleum. Mere reading of the dictionary should give sales personnel an intelligent and interesting conversational knowledge about the products they sell. To the newcomer to the oil industry it offers a liberal education of a practical nature.

RED DEVIL

SLUSH PUMP VALVES

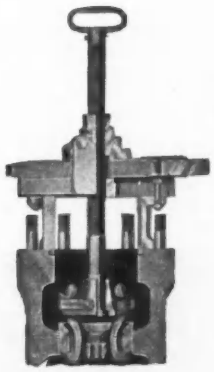
For high pressure abrasive service

In the manufacture of Red Devil Valves, particular emphasis has been given to HIGH PRESSURE ABRASIVE SERVICE at lowest possible operating costs. Their design is unique in simplicity, having only 5 parts. Valve and Seat are drop forged for maximum strength and processed for a deep high-carbon case to withstand excessive abrasive action. Seat has the least possible flow restriction and flat surface on bottom provides easy removal with Valve Seat Puller. "DIA-TEX" Inserts are Oil and Heat Resistant and can be reversed when worn on one side to double their long service life.

Write for Catalog No. P-110.

SPRING LOCK WASHER | VALVE INSERT PLATE | REVERSIBLE "DIA-TEX" VALVE INSERT | VALVE | VALVE SEAT

RED DEVIL VALVE SEAT PULLER



Provides a fast and positive means for pulling badly stuck valve seats by gripping the bottom rim of the seat. Eliminates the expense and hazards of removing seats with a cutting torch. All parts are made of highest grade alloy steel. Write for Catalog No. P-111.

CONSULT YOUR COMPOSITE. For full information on Red Devil Valves, Pullers and other Products, see Composite Catalog or write for price catalogs noted above. Red Devil Products are available through your supply store.

OIL WELL MANUFACTURING CORP.

6008 S. Alameda St., Los Angeles 1, Calif.

Avoid Pulling Jobs . . .

Use O'Bannon

MERCURY ROD PUMPS

Made to wear longer in tough wells, this sturdy precision made, all metal pump, has 1" bore which makes it ideal for small volume wells. It is available in four types: Traveling Barrel Type (illustrated), Stationary Barrel Type with Top Hold-Down, Stationary Barrel Type with Bottom Hold-Down, and Stationary Barrel Type with Bottom Discharge Valve.

●

The performance of the Stationary Barrel Type with Bottom Discharge Valve has been outstanding in wells where sand or gas cause trouble. In this pump the plunger is plugged to increase the compression ratio to prevent gas lock. Fluid is discharged just above the seating device, preventing sand from accumulating above the holddown.

●

Here are other plus features you get with a Mercury:

Anti-mag Cages — Minimized effect of lodestone.

Cro-Lay Plunger — Resists abrasion and corrosion.

Hardened Liners — Resist wear and are easy to align.

Chromalloy Balls and Seats —Resist abrasion and corrosion. Upper and lower valves are oversize, do not foul easily.

Ask your O'Bannon representative for a demonstration of this pump.

SOLD BY SUPPLY STORES

WALTER O'BANNON COMPANY

TULSA 1, OKLAHOMA

Bill's Letter to His Milkman

Twenty-four years ago, *The Oil Weekly*, as WORLD OIL was known then, published a letter from Bill Pigue, its Pittsburgh representative, to his milkman. The letter was a serious one and Bill did not know that it would ever see print until he found it in the Squeaks from the Bullwheel one morning. A fellow employe had seen the carbon and knew that it was too good to keep.

Its publication probably caused more chuckles than anything printed in "Squeaks" before or since. We still are receiving requests for copies and now we are down to the last copy of the last reprint, so we are printing it again. Bill Pigue has gone to a rich reward years ago. The horses long since have been supplanted by motor trucks on Bill's milk route. (In fact, the dairy company to whom the letter was addressed motorized the route as a result of his letter). The letter will bring a laugh to many of you, and to some it will bring memories of one of the most popular men ever to be a part of the Gulf Publishing Company bunch.—The Editor.

The letter:

Rieck-McJunkin Dairy Co.,
Forbes & Stevenson Sta.,
Pittsburgh, Pa.
Gentlemen:

By referring to your records, you will find that for several years I have been a pretty good customer of yours and that I have paid my bills with reasonable promptness. It may interest you, therefore, to know that we are now approaching the parting of the ways unless you can give me relief from a condition about which I have already complained in writing via wrapping-paper note in milk bottle to your driver.

At the time of my first complaint, I didn't have a pup, but now with the pup added to the otherwise almost-unbearable complications, patience has ceased to be a virture and tolerance but an empty word.

As I advised your driver, in writing, your milkwagon horses have so synchronized their intestinal affairs with their scheduled arrival in front of my home that each and every morning of the year, they deposit in profuse abandon, souvenirs which might be of great value to a farmer or truck-gardener, but which are only something to worry about for the man who lives out of a sack.

For 50 feet directly in front of my door, there is at this very minute unlimited evidence of my steady patronage of your good concern, and in the continued absence of rain I am liable at any time to be hailed before

LOADCRAFT'S BUILT TO HAUL 'EM

TANDEM OR SINGLE AXLE SEMI-FLOATS ALL TYPES OF POLE TRAILERS

Heavy loads over rough oil fields demand trailers and floats that are built rugged and can assure safe arrival of valuable equipment. That's why, for over thirty-six years, leaders in the oil industry have chosen "Loadcraft" to do the job. Bodies, fifth-wheel, axles and brakes are all designed and built right in the Loadcraft factory by experienced, quality-conscious Loadcraftsmen. Loadcraft Trailers have proved to be the work-horse of every oil field.

SPENCER SAFFORD **LOADCRAFT** INC. AUGUSTA, KANS.

What's NEW

In Perforating, Logging, and Fishing Tool Services

McCULLOUGH®
NEW SERVICES • NEW TOOLS
NEW WAYS OF DOING THINGS

Latest News About New Tools, Techniques and Services

THREE HOURS *and 55 MINUTES*

That's all it took to locate the stuck point at 10,600 feet and back-off with McCullough Magna-Tector and String Shot.

McCullough Back-Off Service Is Fast — 1

All free pipe can be removed from the well before it has a chance to stick further up the hole. A common occurrence if action is not taken immediately. The McCullough Magna-Tector and String Shot locate the lowest free point and loosen all free pipe in a matter of hours compared to the days needed by other methods. For example: Drill pipe was stuck at 10,600 feet. The Magna-Tector located the stuck point just above the drill collars. A String Shot loosened the first joint above the stuck point and pipe was recovered without damage. Total time was three hours and 55 minutes.

All Free Pipe Recovered In Two Easy Steps — 2

First, the Magna-Tector locates the stuck point — within inches — within minutes. Second, the String Shot loosens the first joint above the stuck point. All free pipe is recovered at one time. For example: An operator estimated the stuck point of his drill pipe to be at about 4200 feet. However, the Magna-Tector located the stuck point at 5362 feet. The String Shot loosened the first free joint at 5350 feet. All free pipe was recovered at one time. Actually, the operator received a bonus of 1150 feet of pipe he didn't expect to recover so easily and subsequent fishing operations were simplified and speeded.

Magna-Tector Saves Fishing Jobs — 3

The Magna-Tector not only locates the stuck point in drill pipe, casing, or tubing, but many times indicates the sticking medium, and in some cases working and/or spotting oil in the tight place indicated by the Magna-Tector, has freed the pipe. This is a fairly common occurrence and has eliminated many fishing jobs. For example: Drill pipe was stuck at 8340 feet. The Magna-Tector located the stuck point at 6540 feet. However, the Magna-Tector indicated that the pipe was frictionally held by compacted shale or sand. Working the drill pipe loosened the string, freeing it deeper and deeper down the well until all the drill pipe was free. The Magna-Tector and immediate action saved the operator many hundreds of dollars.

Unusual Jobs Accomplished — 4

The McCullough Magna-Tector and String Shot save the operator untold hours of rig time because of their ability to perform the tough, unusual jobs. Jobs such as back-off operations through the restricted I. D. of fishing tools, production packers, etc.—operations in high angle holes—operations under excessive pressure and temperature—and many others. For example: An operator's tubing was stuck in 7" casing. The Magna-Tector revealed that the packer was stuck. A fifteen foot String Shot, 200 grains of explosive per foot, was placed through the body of packer and detonated. Packer came loose immediately. There was no damage to tubing or packer.

No Substitute For Experience — 5

Over 10,000 jobs, successfully completed, make up McCullough's backlog of experience in back-off operations. Our equipment is the most efficient and dependable available. Our Servicemen have wider experience in back-off operations than any other group of men in the oil industry. They are specialists—specialists in getting pipe out of the hole in the fastest possible time at the least possible cost—specialists in saving you time, money, and pipe.

So, for MORE drilling time and LESS down time—CALL McCULLOUGH.

WRITE TODAY for your free copy of Technical Bulletin No. 401 on McCullough Magna-Tector and String Shot Back-off Service.

PERFORATING, RADIATION LOGGING, AND FISHING TOOL SERVICE—ANYWHERE—ANYTIME.

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Mid-Continent NEWS

WE'RE IN THE SWING AT SHREVEPORT . . .

. . . with a re-located store and office on the "New Supply Row" at 1300 North Market Street. It's one of our shiny, new, standard oil field buildings—but it's the same reliable "Around the Clock" Service.

MID-CONTINENT Supply Company

General Offices Mid-Continent Bldg. FORT WORTH, TEXAS

SQUEAKS FROM THE BULLWHEEL

the powers that be and tried for obstructing the traffic.

You may wonder, and you have a right to wonder, where and why the pup enters into this matter between you and me and your milk-wagon horses. In the words of that immortal poet, Chick Sale, I'll tell you why:

Ours is a trader pup and we have treated him well. Full of gratitude but having neither silver nor gold with which to show it, he renders unto us only that which he has—and all he has is the choicest collection of your horses' excellently-timed souvenirs which he religiously deposits on the front porch each morning. Sometimes they sweep well, sometimes they do not.

Now, sirs, I don't know what you are going to do about this, but they're your horses. You may be able to use moral suasion, explaining to the horses that times are bad and business hard to get, and the customer is always right; that, however good their intentions may be, not all people like all things—and they should be less partial, passing their favors more generally over the neighborhood rather than upon a single family.

In my complaint to your driver, I suggested that he stop his horses around the corner or come some other route occasionally so that a horse with even the hardiest intestinal fortitude may be overtaxed before he reaches my place, but my plea went unheard. At least there was no action—not on the part of the driver. I mean.

I am terribly serious about this, gentlemen. If you have any idea that I am suffering with the heat or something, that I have exaggerated by one jot or one tittle, I invite you to send an inspector out to 1106 Dormont Avenue before any great cloudburst hits us and take a look—not only a look at the street in front of my house, but if he is early enough, at my front porch. He may even interview the pup.

It is up to you. Unless I have relief commensurate with the relief which your horses have been enjoying for so many months that it really doesn't matter, my monthly checks will cease to clear through your bank.

Assuring you of my greatest respect, which, however, is not the least to be allowed to interfere with my great determination for succor, I am

Yours cordially,
W. W. PIGUE.

Going Down!

A passenger in a plane sat relaxed at the window drinking in the spectacle of the heavens sliding by. Suddenly a parachutist appeared and drifted by.

"Going to join me?" cried the parachutist.

"Thank you very much," replied the passenger. "I'm very happy just where I am."

"Just as you like," called back the parachutist.

"I'm the pilot."